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THE

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HINTS ON THE IMPROVEMENT OF COTTAGES.

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Hindrances in the way of Cottage Improvement.

A traveller, in passing through a strange, but civilised country, might form a correct judgment respecting the social condition of its rural inhabitants by observing attentively the state, character, and general appearance of their dwellings. On beholding a manor-house, or baronial mansion, surrounded by commodious and comfortable cottages, in the midst of smiling corn-fields and meadows, he might rest satisfied that he was in a country where the true patriarchal system of life existed—that system under which society is in a condition equally removed from the anarchical and the feudal. On the other hand, where ruined huts and uncomfortable cottages are seen upon an estate which possesses an elegant mansion-house and park, the cause of their existence in such a state may be sought for in the prevalence of the "middle-man" system, so common in some parts of Ireland. Under this system, which must be carefully distinguished from that of cottage allotments as practised in England, wretched cottages, or rather hovels, are erected by tenants at will, or tenants on short leases, of clay, mud, or turf; many of them without windows or chimneys, and lighted and ventilated only by the door and by holes in the ill-thatched roofs. The builders of these cottages know not how long they may remain in their possession, and though they were able, would be unwilling to lay out money on buildings which they may have to leave within a year or two. Wherever the middle-man system prevails in all its characteristics, miserable cottage dwellings are uniformly to be seen.

In some parts of Scotland there may be observed commodious farm-houses and homesteads, built of neatly dressed stones, and having the roofs covered with slates—the windows being large and cheerful, and the general expression of the whole group of

buildings giving an idea of wealth and comfort; while, at a little distance, may be seen groups of wretched farm cottages, the dwellings of ploughmen and their families, with low ruinous walls, small ill-glazed windows, ill-thatched roofs, and a general appearance of depression and misery. The observer of such a combination of fine and wretched buildings may conclude with certainty, that the house and homestead have been built at the proprietor's expense, and that, from having a family interest in his estate, he has endeavoured to erect them in a complete and durable manner; while the farmer has been left, in accordance with the rules of custom, to find accommodation for his servants as he best may, and, having no interest in the place beyond the extent of his lease, has spent as little money as possible on the erection of his servants' cottages, considering that the extent of an ordinary lease gives little security for the value of money expended on buildings. In the very best cultivated districts of Scotland this system prevails. Farmers expend money on draining and other improvements, expecting to be refunded by the increased value of the soil before their lease is expired; but they cannot be expected to lay out L.60, or thereby, in building a complete cottage, when they know it will be no longer their property after perhaps nineteen years; and that though they were to let it for rent during their lease, the united rents of nineteen years would not nearly repay the first expense, with accumulated interest.

An intelligent periodical writer thus gives a descriptive sketch of a farm servant's cottage, built by a tenant farmer, and which existed about thirty years ago in a certain part of Forfarshire:—

It was built of turf and whinstones, near the foot of a swardy hill that ascends to the first range of the Grampians. To prevent the water, which often pours in torrents from the rising grounds, from doing irreparable damage to the frail "biggin," a ditch was dug around it, with proper water-courses for carrying away the speat in rainy seasons. The inhabitants had also the under-ground water, or the water which sprang out of the floor, to contend with. In order to carry it off, a drain of three or four inches deep was dug around the inside of the house, with angles, off-sets, and crossings—below beds, chests, and tables —all centring at a cut below the door, by which the water found its way to the outside, and thence to the bottom of the hill. The floor and the hill were not the only quarters from which the inhabitants were troubled with a superfluous supply of water—the roof likewise lent its aid in keeping them cool. The water that descended through it was of such a colour that novices might have taken it for excellent brandy; but the sooty taste of a drop would have convinced them that the highly-coloured liquid was something else than real cognac.

Regarding the present condition of farm cottages in the same part of the country, the same writer thus records his observations:—

The houses now inhabited by married farm-servants present in general a better appearance externally than they did at the times about which I write; but as yet they are anything but comfortable inside. Turf and thatch have, in most instances, given place to grey slates. Better materials being used for roofing

render them dry above, and I believe that none require a system of surface draining such as I have mentioned; but as few of them are either ceiled, plastered, lofted, or have anything in the shape of joiner work except the outer door and the windows, in frosty weather the cold is keenly felt by the inmates. To make up, as far as possible, for the want of partitions, the inhabitants arrange their furniture so as to procure the greatest possible degree of warmth; *and were it not for the uncertain tenure by which they retain their holdings*, my belief is that they would, at their own expense, render them far more comfortable, as the necessary improvements could be made at the cost of a few shillings.

In confirmation of this intelligent observer's opinion, expressed to the effect that cottagers are not insensible to outward comfort in regard to their dwellings, it may be remarked, that when a working man has once amassed as much money as will enable him to feu a piece of ground, and build a house thereon for himself, he at once shows in what manner he values comfort, convenience, and even beauty, by erecting a house far superior in neatness and arrangement to the building in which he may have formerly lived. As a means, then, of furthering the improvement of cottage dwellings, they should be built only by landed proprietors, or by feuars, or persons having a perpetual lease of the ground whereon they stand.

Assuming, then, that landed proprietors will feel inclined to find accommodation for the farm-servants on their estates more comfortable than that provided for the live stock of their farmers, it may be interesting to enquire into the reason why so many of those cottages already erected by landlords, while greatly improved in regard to material and construction, when compared with other cottages, are still very deficient in arrangement and design. The main causes are, that some of these cottages have been planned by persons who have never studied the first principles of cottage architecture,* and that others have been designed by thoroughly bred architects (in the common acceptation of the term), who may have turned their attention chiefly to the principles of design as applied to villas, mansions, and street-houses, or who have been reared in the rigid school of precedent, and consider themselves as safe only when journeying in a path which has been well beaten by former travellers. Some architects look upon their art as one of imitation, when it is, in reality, one of reason. Architects have too long intrenched themselves behind the wall of precedent—a wall at one time considered strong and impregnable, but in which several breaches have been made by the publication of such works as Loudon's Encyclopædia of Cottage, Farm, and Villa Architecture. That excellent and standard volume, to-

* "It is by country builders, carpenters, masons, and bricklayers, that the great majority of country buildings are both designed and executed. For the general improvement of cottages, therefore, we must educate the eye of the country carpenter and mason, and give the cottager himself a taste for architectural and gardenesque beauty."—(*Loudon's Encyclopædia of Architecture.*)

gether with several other minor publications which have followed in its wake, has tended to show that even cottage architecture is an art, in the study of which the reasoning faculties ought to be exercised; and an art, the study and enjoyment whereof is accessible to every one who has eyes to observe, and a mind to contemplate. Such works have been beneficial to architects, considered as professional men, rather than otherwise. They have been instrumental in creating a taste for architectural beauty and fitness in the mind of the public, and thus opened up a field for a display of talent and judgment in the members of the architectural profession.

Let, then, cottages be designed by educated tradesmen, or by architects of reason, and not by architects of precedent; and let them be built by persons having an interest in the soil whereon they stand, and the age of ill-built and ill-planned cottage dwellings will soon pass away. Let proprietors build on their own account, or let joint-stock companies build villages as a mutual concern; and, if the dwellings are planned and arranged according to the dictates of reason and judgment, the face of the country will soon be adorned by beautiful cottages and cheerful-looking villages;* and the passing traveller will be impressed with the

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* On the subject of cottage improvement and certain hindrances thereto, the following observations by the late J. C. Loudon, may be found in the fourth volume of the Gardener's Magazine:—

"One cause of the miserable accommodation in the lodges at gentlemen's gates, and also in gardeners' houses, may be traced to the want of sympathy with those whom they consider beneath them, on the part of architects, landscape gardeners, and builders. The greater number of these persons being sprung from the people, necessarily have more or less the character of *parvenus*, when introduced into the society of the higher classes. Observing the disdain wherewith [some members of] these classes look on the mass of the people, they naturally avoid everything which may remind either themselves, or the society into which they have been introduced, of their low origin. Hence they fear, that to advocate the cause of the class from which they sprang, to be thought to care about their comfort, or to suggest improvements in their dwellings, would remind the employer of their origin, and be thought derogatory to their newly acquired station. An architect, or a landscape gardener, therefore, who has sprung from the people, is rarely found with the moral courage necessary to propose, to the rich who employ him, ameliorations of any kind for the poor." . . . . "It is clearly both the duty and interest of the higher classes, to raise, by every means, the standard of enjoyment among all that are under them. Humanity dictates this line of action, as well as prudence; for it would be easy to show, that, if improvement did not pervade every part of society, the breach between the extreme parts would soon become so great as to end in open rupture. The more the comforts, enjoyments, and even luxuries, of every servant, from the highest to the lowest, are increased, the more will they be useful, assiduous, and attached to their masters." By thus advocating the cause of cottage improvement in his periodical works, and especially by the publication of his Encyclopædia of Cottage Architecture, Mr Loudon has been the means of drawing public attention to the subject, and of commencing a reformation in the condition of cottages, which it is hoped will yet extend throughout the kingdom.

idea that he is amongst a comfortable, happy, and contented race of beings—that the patriarchal system in rural districts, and the co-operative or joint-stock system in the neighbourhood of large towns, have, with the aid of science, succeeded in rendering the labouring population of the country comfortable, in as far as comfort depends on the inward convenience and general character and condition of cottage dwellings.

There exists one other barrier in the way of cottage improvement, and one that bears relation to the dispositions of cottagers themselves. Many cottagers have little or no taste for the inward improvement or outward embellishment of their dwellings. Some remarks on the best means for producing a taste of this kind will be given in another chapter.

Improvement in Arrangement and Construction.

Man, in a savage or uncivilised state, in erecting a hut to shelter him from rain, wind, or cold, generally forms it so as best to attain the end in view. In Ethiopia, where heavy periodical rains fall, the huts are round in their ground plan, with steep conical roofs covered with thatch, each hut bearing some resemblance in form to a stack of corn. In Lower Egypt, and other countries, where rain is almost unknown, platforms and terraces are formed on the tops of houses, as in such countries it is not necessary to have sloped roofs. In countries where boisterous winds prevail, houses are built compact and low. In cold countries, savages build their huts in the form of a semi-globe, like an orange cut in two, and one half placed with its flat surface on the ground, thus securing the greatest amount of internal space compatible with the least exposure of outer surface. In huts of this form, the fires are placed in the middle of the floor, and the smoke escapes by an opening in the roof; thus preventing that waste of heat and fuel which would occur were the fires to be kindled at one side of the apartment close to an outside wall. In some parts of Scotland, cottages with central fireplaces still exist; and in former times it was the general custom to arrange the interior of cottage dwellings in this manner throughout the country. The ancient stone and turf huts of Scotland were thus rendered more warm, though at the same time more smoky, than otherwise they would have been. As civilisation advanced, and when cottages came to be enlarged and divided into two or more apartments, the fires were removed from the middle of the floors and placed against the end walls; but still were made to project into the interior, instead of being formed in recesses, as has now become customary. The comforts afforded by one of these projecting fireplaces have been celebrated by Burns in one of his poems, when, in describing the pleasures of a fireside in a

cold and stormy night, he represents the cottage inmates as being seated—

"Fast by an ingle bleezin' finely."

The chimneys of these fireplaces were in a measure independent of the gable walls against which they were placed,—the vents being carried up within a framework of wooden posts, filled in with a mixture of clay and straw. When stone, lime, and slates came to be used in the construction of cottages, the fires were placed in recesses left in building the end walls, and the smoke flues were carried up in the mason-work; and, with fireplaces of this kind, are the generality of new cottages built at the present day. The evils of this arrangement are various:—

1st, A great portion of the heat generated in the fireplace is absorbed by the mason-work, passes through the wall, and is wasted in the open air.

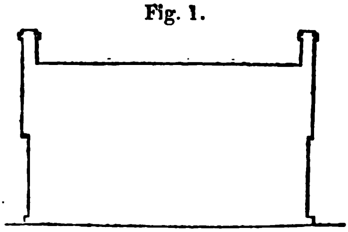
2d, The central parts of the cottage, should it be long and narrow in the ground plan, receive little benefit from the fires.

3d, A portion of the cottager's fuel, which may have been dearly bought, is rendered useless.

4th, When a cottager can only afford to keep one fire burning at a time, the other end of his dwelling from that in which he lives gets cold, damp, and uncomfortable; injurious to health, and hurtful to articles of furniture.

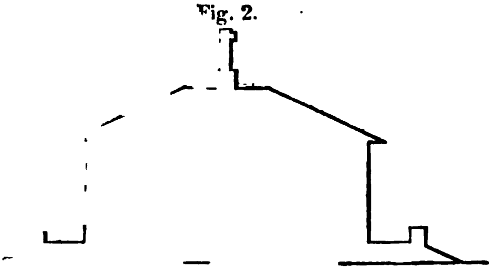
5th, A chimney in an outside wall contains a column of cold air, the lower part of which is long in being heated after the fire is kindled, rendering it difficult to create a proper draught for smoke in such a chimney.

Fig. 1.



6th, A person of taste laments the want of symmetrical effect, occasioned by the rising up of a straggling chimney at each end of a cottage, as in fig. 1. When this outline of a common cottage is contrasted with that represented by fig. 2, the effect produced by a mass of chimneys elevated above a central part of the roof, and throwing the various lines and forms of the cottage into a harmonious *whole*, is easily observable.

Fig. 2.



In new cottages it has been attempted to avoid these

evils, by placing the fires against interior walls; but, in so doing, an additional evil has in some cases been incurred, namely, that of having the door of a room placed so as to open hard by its fireplace, thus destroying the comfort of the apartment; and this evil can scarcely be avoided by designers who suffer themselves to be slavishly bound down to precedent. It requires some thought on the part of an architect to arrange the detailed plan of a cottage so as to avoid this evil, and secure at the same time the benefit of having central fire-places; but were proprietors or intending builders to lay down to the architects they employ the following rules in an imperative manner, architects would soon, by departing from precedent, overcome imaginary difficulties, and find that it required only a slight process of thinking to show, that these short and simple rules might be very easily attended to, irreconcilable as they at first sight may seem:—

Rule I.—The fire-places to be formed in an interior wall, and in a central part of the building.

II.—No door opening into a room to be near to, or on the same side of the apartment with, the fire-place.

Fig. 3, drawn to a scale of 1 inch to 20 feet, is the detailed plan of a single cottage, in the arrangement of which these rules have been observed. The main body of the building is in the form of a parallelogram, 34 feet long, and 26 feet wide, over walls. A stone or brick wall, running from end to end along the centre of the building, divides the interior into two equal portions. The front half is subdivided into two apartments, with a passage between. This passage leads to three small but independent bed-rooms in the other half of the cottage. There is a fire-place in the kitchen, and another in the parlour, and that portion of the heat which, had these fire-places been in the end walls, would have been dissipated in the open air, is retained for warming and preserving from damp the bed-rooms. The doors to the kitchen and parlour are at the corners farthest removed from the fire-place; an arrangement desirable in every case for the sake of proper ventilation, for avoiding draughts of air, and the drawing down of smoke when they are opened and shut, and for the general comfort and convenience of the cottage inmates. A back court and several outhouses are shown in connexion with the building.

Fig. 3.

Should it be preferred to build these outhouses separately, the windows of the cottage are so arranged as to produce perfect symmetry and regularity in all the four sides of the main building.

Accommodation.—There is an entrance lobby or passage, *a*; a kitchen and parlour, *b* and *c*, each 13 ft. by 10 ft.; three bed-rooms, *d*; back court, *e*; and outhouses of various kinds, *f*, *g*, *h*, *i*, *k*. The place marked *f* may be used as a scullery, place for lumber, or wash-house, in which case a boiler may be erected in the corner next the poultry-house, *g*, which would be benefited by the spare heat. Should the cottager keep a cow, *f* may be used as a cow-house.

Expense.—The walls being plain and free from breaks and angles, and the general form approaching to that of a cube, this cottage might be erected by a feuar who had every kind of materials to purchase for the sum of £124; or by a landlord who could furnish the stones and all the homewood used in the building from his estate for the sum of £96.

A third rule for the guidance of designers is illustrated in the above plan, namely, this:—When a family is large, there ought to be, at least, three sleeping apartments. It may not be possible in every case to have three rooms set apart for sleeping in, as in fig. 3. Concealed beds may in some cases, where economy in outlay is an object, be introduced into the living-rooms; but where they can be got it is most advisable to have separate sleeping rooms, and if they are in a second storey so much the better. Separate sleeping apartments, especially when ascended to by a staircase, are conducive to health and habits of cleanliness. Where, however, it is found necessary to introduce beds into living-rooms, they should be concealed in recesses, and ought to be fixtures belonging to the owner of the cottage. Box-beds, the property of tenant cottagers, are the production of expediency, and show how much may be done to produce comfort in the interior of partitionless cottages when necessity is the impelling motive. Though concealed beds are admissible when there is not space allowed for separate bedrooms, yet these should be formed in all possible cases. They need not be large, but the smaller they are, means of ventilation should be the more completely provided. The upper portions of the window sashes should be made to draw down from the top; and to prevent the health of the cottagers suffering from their own carelessness, the upper sashes may be hung so as to leave a space under the lintel about a quarter of an inch in width, and a slip of zinc with small holes bored in it may be fixed in this open space, to regulate the force of the air-currents that will enter the room whenever the temperature of the cottage is elevated above that of the open air. Were this simple resource provided in the formation of cottage windows and doors, heated air would never be suffered to stagnate in the upper part of the rooms; the fires would be supplied

with the inflammable part of air without producing currents of cold air in the lower part of the rooms, to the inconvenience of the inmates; and chimneys, if rightly constructed in themselves, would always draw well.

Fig. 4 is the ground plan of a double cottage for two families. The smallest cottage contains a living-room *c*, over which may be one large or two small bed-rooms; a staircase *b*, lobby *a*, and back kitchen *d*, in which there is a boiler. The other cottage contains on the ground floor, a living-room *g*, three closets, *f*, *i*, *k*, and a back kitchen *h*, with boiler; the staircase *e* leads to two large bed-rooms. The respective back kitchens open into a common back court, in which convenient outhouses may be built separately from the main building, which has been so designed as to present equal pretensions to beauty of form in all its elevations. One of the elevations is shown in fig. 5. The upper storey, the bed-rooms

Fig. 4.

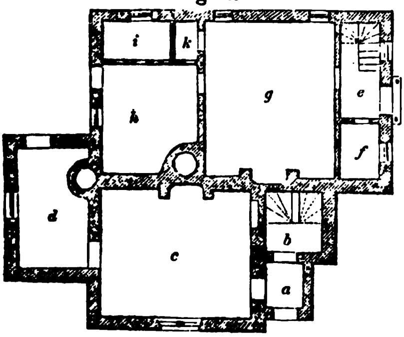
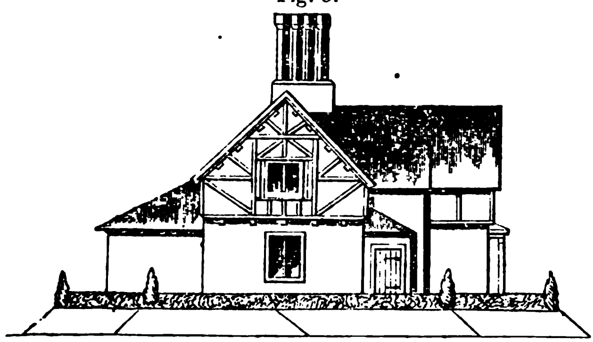


Fig. 5.



in which are partly in the roof, is exhibited as having been formed in the style of the ancient half-timbered houses of England. In wooded countries, such houses may very appropriately be erected as ornamental objects. The lower storey may be built of stone, or of bricks covered with cement. In cases where it is intended to raise bed-room floors on one-storied cottages already existing, the second stories may be built in the half-timbered style; the walls being raised in timber framing to the height of four feet above the bedroom floors; and the requisite height of the apartments being gained by forming coved ceilings. Under well thatched roofs these bed-rooms would be warm and comfortable.

Coved ceilings should never be formed under slate roofs, as slates admit heat too freely in summer, and cold just as freely in winter. The following details respecting the construction of half-timbered dwellings are taken from Ricauti's *Rustic Architecture*, an interesting volume, which teaches in what manner cottages may be both cheaply and appropriately ornamented:—

In framing the roof, British fir may be used for the ridge-piece, nine inches by two inches, and the wall plates, six inches by four inches, which are continued through the walls. The ceiling joists are to be of rough wood, four inches by three inches, also continued through the walls. The collars of rough wood, five inches by three inches, notched down on the joists, and the openings boarded, or lath-and-plastered, so as to form ceilings. Forest timber, or the loppings of trees, may be chopped into shape, about six inches by three inches, for the rafters; these are crossed with light stuff, and covered with thatch. The inside of the walls may be battened, and lath-and-plastered, and coloured with the following preparation, which, when properly mixed, will cover twenty-six square yards:—Quicklime, six ounces, rubbed down with a muller to free it from all roughness; linseed oil, six ounces; Burgundy pitch, two ounces; skimmed milk, two quarts. The pitch to be melted with the oil over a gentle fire, and gradually incorporated with the mixture. Any kind of colouring ingredient may be added to bring it to the tint required. The doors to be hung with T hinges, twelve inches long, ornamented with rough wood. The ceiling joists, collars, wall-plates, &c., in the interior should not be concealed; for they may be rendered highly ornamental, both as a canted cornice and as a ribbed ceiling. This will be quite in character with the exterior parts of the building, with no additional expense, but only the exercise of a little taste in applying the material.

This kind of building is economical; but it is unadvisable to use it in a very cold climate.

Every labourer's cottage should contain an entrance porch, passage, or lobby. A porch shelters the entrance from wind and rain, thus adding to the comfort of the interior. No cottage in the climate of Scotland, or the northern parts of England, can be at all comfortable whose entrance door opens immediately into the living-room of the family. In a cold climate it is desirable to have both an inner lobby and an outer porch, consisting of open pillars supporting a roof. A porch may be made highly ornamental if its pillars are formed of squared or rounded timber, painted a wood colour, and placed as the supports of an independent roof; but when the roof of a porch is only a portion of the main roof sloping downwards to the top of the pillars, the appearance is mean and slouching. Rustic or knotty unbarked pillars supporting a roof formed of durable materials, are out of place, and do not harmonise in expression with the materials which rest upon them. They seem to be placed where they are as a temporary expedient before more durable-looking pillars can be obtained, and thus appear to be contrary to received ideas of propriety and fitness. When a porch is extended round one or more sides of a cottage, it is called a covered verandah, and will be found useful in rainy weather for many purposes, such as drying seeds and clothes. A verandah protects the cottage walls

from the moisture communicated to them, when unsheltered, by driving rains. Where there is no verandah to protect the walls of a much exposed cottage, Irish ivy may be trained to form, by its broad and pendulous leaves, a natural and efficient weather tiling. The pillars of a porch or covered verandah, if formed of timber, should be smoothly planed, and may be square, round, or octagonal in their horizontal section. They should appear to rest on solid stone pedestals, and may be surmounted by plain wooden capitals. Light and ornamental pillars of cast iron may be used in the construction of verandahs; but they should in every case be painted of such a colour as will show that they are of metal. In some churches lately erected, there may be seen cast iron pillars of small diameter, painted so as to resemble wainscot, and thus create an appearance of weakness and insufficiency. An iron pillar will support as much weight as a wooden one of twice its thickness; and so, if it be painted of a wood colour, it will appear to be too weak for its purpose by the one half. In few arts are the principles of fitness and propriety more outraged than in that of house-painting. A safe rule to be observed by those who practise this art is, to paint every object in such a manner as will show at once the materials whereof it is composed—whether these materials be wood, stone, iron, or plaster.

Underneath a porch or verandah covered with glass, vines and tender exotic flowers may be trained successfully when the exposure is suitable. A love for flowers on the part of a cottager is indicative of refined feeling.

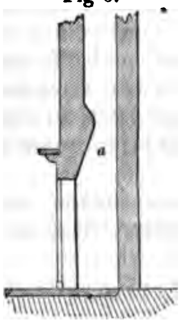
In constructing an open porch, the floor may be paved with tiles or flag-stones, and the ceiling plastered. It may contain seats on each side, and a scraper and mat will complete its appendages. The inner lobby or passage should be paved and ceiled, and along its walls may be placed shelves for small tools, seeds, and other articles. An intelligent cottager might make these shelves characteristic of his daily employment. Thus a quarryman might arrange on them geological specimens from the different quarries in which he may have wrought, and a forester might adorn them with polished sectional cuts of trees, or with deer's horns.

The height of the kitchen, which is generally the cottager's living-room, may be from eight to nine feet. The window should be large and high for the sake of light and ventilation. An under stratum of broken bricks, stones, and lime riddlings, more or less deep according to the nature of the subsoil, and communicating with the open air by gratings in the foundations, for the circulation of air, will prevent a paved floor from remaining long damp after being washed. The floor of a kitchen may be of bricks, tiles, or stones. Asphalte floors are unsuitable for

kitchens, unless means be taken to prevent accidents from fire. They can be formed with perfect safety in ground-floor rooms, where no fires are kindled. Artificial drainage is necessary under ground floors where the subsoil is not naturally porous. Earthen or mud floors on a damp subsoil are always in a moist condition. In some old cottages, where drainage has not been attended to, springs of water ascend through the earthen floors; and as, in many instances, the floors of old cottages are formed under the surrounding ground level, their inhabitants are often put to sad shifts to get rid of superfluous water.

The most important part of a kitchen is the fire-place. The opening between the jambs may be from three to four feet, and the throat of the chimney should be contracted to the width of about seven inches, (as at *a*, fig. 6, drawn to a scale of one inch to five feet,) about a foot and a half above the lower edge of the lintel, and then widened to the usual diameter; so that, when the space under the throat is filled with heated air, a draught may be created, and the smoke prevented from descending after it has once passed the throat. Various kinds of cheap kitchen ranges are now manufactured and supplied to builders wholesale. In certain parts of the country where wood for fuel is plentiful, and coals not to be obtained without difficult carriage, the old fashioned open fire-places, wherein fagots may be burned, possess several advantages over fire-places inclosed within narrow stone jambs.

Fig 6.

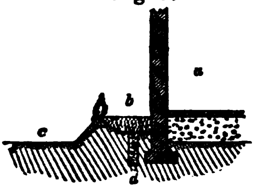


It adds much to the convenience of a cottage to have a back kitchen or scullery adjoining the kitchen, when this last is used as a living-room. The back kitchen may contain a sink with a drain to convey all soap-suds, &c., to a liquid manure tank.

A pantry is requisite in every cottage, and is most convenient when near the kitchen. Where a cow is kept, the dairy may communicate with the back kitchen, or passage leading thereto. In some old cottages, unfurnished with a dairy, milk has to be placed on shelves in the living-room, where it soon turns sour. The shelves of a dairy may be formed of timber, Caithness flagstones, or slates.

In small cottages, one of the sleeping apartments may be used [illegible] parlour, containing a concealed bed. The floors of [illegible]ing-rooms may be of deal boarding or asphalte. Deal [illegible] should have an open space below them, and the earth [illegible] of this space may be spread around the cottage, so as [illegible] a terrace. In fig. 7, *a* represents in section part of [illegible] floor on a stratum of broken bricks, &c.; *b* a terrace

Fig. 7.



of earth and gravel, edged with a spruce or box hedge, and sloping downwards at an angle of 45° to the ground level *c*; *d* is the position of a drain. The walls and ceilings of sleeping-rooms should be lath-and-plastered, so that they may be white-washed, coloured with a warm tint in water-colours, or papered. Bed-rooms are most convenient when entered independently of each other from a common passage.

In the present state of society in Scotland, it is unnecessary to append such conveniences as bake and brew-houses and cellars to labourers' cottages. These parts of a cottage will be introduced, as they have been in other countries, when the wants of society render them necessary. The cottage-designer's business is to provide for wants that already exist, in a rational and efficient manner. Complete water-closets being expensive at first, and liable to go out of repair, are less suitable for cottages than out-of-door conveniences, connected immediately with liquid manure tanks.

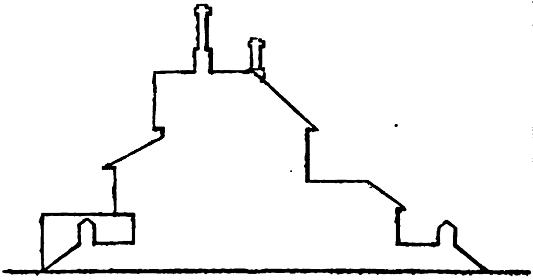
The pigsty, cowhouse, root cellar, and other outhouses, may either be built separately or connected with the cottage by a back court.

Improvement in the External Appearance of Cottages.

Symmetry.—Those who have had an opportunity of studying the productions of Italian landscape-painters, must often have observed, with feelings of delight, how perfectly a beautiful symmetry is often exhibited in perspective views of irregular buildings, by a proper arrangement of parts, differing in shape, width, and height. Square, round, and pyramidal forms, blended together, and concentrating around one grand leading object, are made to produce perfect symmetry, although no one part may be in shape or dimensions like another. In the specimens of landscape architecture exhibited in the paintings of Raphael, Guido, Lorraine, Angelo, and others, the square, round, and spiral towers of ancient Italy are often introduced into the same building with the happiest symmetrical effect. In one of Raphael's irregular edifices, a central column is introduced for the sake of throwing the whole building into a pyramidal form, thus producing symmetry in the midst of variety. Were this column hidden from the view by any intervening object, the outline of the building would be confused and incomplete.

The word *symmetry*, it is said by lexicographers, signifies the adaptation of parts to each other, proportion, harmony, agreement of one part to another. In regular or Grecian architecture,

one-half of a building just reflects the other; and a portico in front, or a dome on the roof, forms the requisite centre of union, producing symmetry out of sameness and regularity. In Gothic and Italian edifices, symmetry is produced by a kind of *irregular regularity*. This is the kind of symmetry which designers of ornamental cottages should strive to produce. In fig. 8, the outline of an irregular two-storeyed cottage is shown as a specimen of a near approach to symmetry, produced by dissimilar lines and forms. The elevations of the plan shown in fig. 3, will partake of that kind of symmetry which characterises Grecian buildings.



Congruity.—This includes suitableness, agreeableness, fitness, and consistency. These principles of design are outraged when materials of an incongruous nature are combined in the erection of the same building. A wooden or earthen walled cottage, when covered with a slate roof, is at variance with congruity, because the walls are of less durable materials than the roof. On the other hand, walls of hewn freestone supporting a roof of spray or thatch, are at variance with the principle of suitableness. They appear to have exhausted the funds of their builder, and rendered him unable to finish his edifice in the same style in which it was begun.

Rustic wooden pillars supporting solid mason work, seem to have been placed where they are as a temporary expedient, before more durable materials could be obtained from the quarry. How would an English half-timbered cottage appear to the eye of reason, were its lower storey to be of timber framing and its upper storey of solid masonry, with a roof of slates or tiles? And yet similar anomalies sometimes occur in the erection of ornamental cottages, for want of attention to the plain principles of congruity. For the sake of agreeableness and consistency, all the four sides of a cottage, or other dwelling, should be equally beautiful when equally exposed to view. When an architect of precedent, who has been accustomed to design street-buildings, is applied to for the plan of a detached cottage, he, in many instances, contrives to produce one, or perhaps two beautiful elevations fair to look at, leaving the rest of the walls

bare and hideous. Architects should remember that a street house and a detached cottage are two very different objects. The one may be seen perhaps from every direction, while the other can only be viewed in passing along the front facing the street. The unseen walls of a street-house may be built of any materials that are strong and durable enough; but a detached building, whether it be a palace or a cottage, when seen from all directions, should be equally ornamented on all sides. Street-designing architects are too often ready to sanction the custom of putting down detached cottages alongside of, and parallel to, a public road; by which means their hideous bare ends of rubble work are seen for miles when passing along the road, while their elegant fronts of hewn stone are only seen, and that to great disadvantage, when the beholder is close upon them. Many sub-urban villas, with splendid fronts and unsightly ends, are placed in this manner by the sides of public roads leading into cities. They present in the estimation of the traveller few indications of real taste on the part of the city architects and builders, and seem to be portions of streets lifted from their original position, like the palace in the *Arabian Nights*, and removed to the out-skirts of the city for the sake of fresh air.

Cheerfulness.—Large and high windows, with clean glass, give an expression of cheerfulness. Cottages have a mean and slouching appearance when their windows are placed so low as to have a great breadth of mason-work above them. There should never be more than four inches of masonry between the top of a window in a one-storeyed cottage and the eave of the roof. Less than three inches might indicate weakness in the lintel. In the interior, also, cheerfulness is produced when the windows rise up close to the cornices of the rooms, and a proper state of ven-tilation is indicated. High and massive chimneys, in the climate of Britain, give a cottage an appearance of cheerfulness, be-cause they are associated in the observer's mind with blazing hearths and comfortable firesides. Latticed windows in cottages are cheerful and picturesque, but they are sometimes constructed so as to be ineffectual in keeping out rain and wind. A cottage raised on a platform or terrace is more cheerful-looking than one the floor of which is on, or under, the ground level.

Blank windows in cottages are deceptive objects, and are never resorted to as expedients for producing symmetry and order by designers whose taste is governed by the dictates of reason. It is more in accordance with true taste to leave walls quite bare than to disfigure them by forming in them blank windows. But an architect of reason finds it unnecessary either to form blank windows or hideous bare walls. He can so ar-range a building as to show, in all its different elevations, an

equal attention to beauty and symmetry, without calling in the arts of deception to his aid; and does not think it necessary, for producing a perfect design, to have walls pierced for windows at regular intervals all round a building, or to have the windows of a second storey placed perpendicularly over those of the lower one. He strives rather to produce a pleasingly intricate design by crowding windows together in one part, and leaving massive portions of masonry in another. He can produce variety of light and shade in a building by breaks and angles, without resorting to any deceptive or useless expedient. He knows how to design a pleasing piece of architecture, in which no windows appear at all, and therefore feels himself independent of any effect which can be produced by false windows in a design, in some portions whereof real windows may be necessary. Those, therefore, who employ architects to design detached dwelling-houses, should lay it down as an imperative rule, that, while the different elevations are expected to be equally beautiful and orderly, no blank windows shall be allowed in any portion of a building. Their introduction, in any instance, would only tend to show that there had been a pretension to taste where true taste was utterly wanting. These remarks apply chiefly to the case of detached buildings. Designers of street-houses, in regular architecture, may sometimes find it necessary to employ false windows for the sake of uniformity, but the seldomer they resort to this expedient the better.

External finishing of Cottages.

Verge-boards, or, as they are commonly termed, barge-boards, are useful, in the character of wind-skews, on the gable ends of cottages, for preventing wind from displacing the materials of the roof; and also for preserving the ends of those pieces of roof timber that project over the walls for the purpose of shelter. The finial and pendant wherewith gables are terminated, are useful for preserving the joinings of the verge-boards, and keeping them in their position. Verge-boards are more expressive of their object, when formed of plain mouldings, than when they are weakened in appearance by gewgaw carvings. For rustic cottages, verge-boards may be constructed of unbarked slabs. In some parts of Russia, peasants ornament the verge-boards and window-facings of their cottages by carving on them, in a rude manner, representations of various objects in nature, such as the sun, moon, and stars. A taste for cottage ornament ought, if possible, to be excited in the minds of cottagers in this country. Incongruous as the Russian cottage ornaments may appear, they still show that refinement has reached a certain

stage of progress in the minds of Russian peasants. The man who endeavours to adorn his dwelling in any manner whatever, shows that he has a more refined mind than he who allows his cottage to remain as it was left by the builder, without attempting by any means to beautify and embellish it. Until a taste for appropriate embellishment is created in the minds of cottagers themselves, it is of little use to build ornamental cottages. Take a peasant with an unrefined mind out of a mud hovel, and place him in an elegantly ornamented cottage, and his happiness might not be in any degree increased; indeed, it might be expected that he would feel a kind of restraint in his new dwelling which he was unaccustomed to before; and would feel as much out of his element as if he were to find himself working in a field in a rainy day, attired in a splendid suit of livery.

The premiums which have been conferred by certain societies on the owners of the cleanliest kept cottages, have produced a marked alteration for the better in the outward appearance of cottages in some parts of the country. There is a latent taste for order and neatness in the human mind, which only requires to be called into action. A taste for orderly arrangement is generally displayed by children as soon as they begin to amuse themselves with their playthings, and they take much delight in singing little nursery rhymes, which, like the following, give expression to ideas of order, symmetry, and neatness:—

> "Mary, Mary—quite contrary—
> How does your garden grow?"
> "Silver bells, and cockle shells,
> And pretty maids all in a row."

Were societies to give premiums for the best ornamented, as well as the cleanliest cottages, this natural taste for neatness and order might soon be called into action in the minds of cottagers.

Costly and fantastic ornaments are out of place in cottage embellishment. A pictureeque simplicity should be aimed at in ornamenting a labourer's cottage. It is incongruous to place on buildings of this class turrets and battlements, in imitation of pointed Gothic and old Scotch baronial edifices, or to adorn them with painted windows and crosses in that ecclesiastical style of architecture which is associated with the age of monasteries. Neither is it in keeping with the principles of congruity to stick up columns and entablatures against a cottage in the style of a Grecian temple.

Parapet Walls may be erected, around the outer edge of cottage terraces, of stone, or of bricks and tiles, at little expense; and they may be crowned on the top with mignonette

boxes of artificial stone, and with vases of a similar construction at the corners, as recommended in Loudon's Encyclopædia of Architecture. Natural parapets may be formed of box or spruce neatly clipped, and cut into artificial figures. On parapets of wire or wicker-work, climbing flowers may be trained in summer.

Chimney-tops, of architectural shapes, and constructed of artificial stone, add much to the beauty of a cottage. They should be placed on massive bases of masonry, rising boldly out of the roof. Chimney-tops in a cold climate ought always to have a conspicuous and prominent appearance in the outline of a dwelling, whether that dwelling be a palace or a cottage; and it is a waste of time to contrive means for keeping them out of view. In a warm climate, the few fire-places that are necessary in dwellings may have inconspicuous chimneys.

Whitewashed cottages produce a glaring and inharmonious effect in landscape scenery. Light warm tints of various kinds may be given them by washing over with solutions of quicklime and copperas, quicklime and tarras, and various other materials, properly mixed. Various plans for protecting outside walls from rain and moisture have been adopted; such as, covering with artificial weather-tiling, or with Irish ivy, the large leaves of which act in the same way as weather tiles. Cement is applied as a protection to walls in various ways. Cottage walls, built of earth, or with stones and mud, are generally protected from the weather in Scotland, by harling, or rough-casting with lime. A harled, or cement-covered wall, is always considered to be formed of inferior materials. A glutinous water colour, which will both resist the action of the atmosphere, and allow the observer to see of what materials a wall is composed, seems to be the kind of outside covering most in keeping with the principles of fitness and consistency.

An architectural expression may be given to cottages by projecting bases and wall-plates, and architectural style may be conveyed by the forms of mouldings in window-frames, door-panels, and chimney-tops, and in general by the lines, angles, and forms of windows, doors, roofs, and chimneys.

Pilasters, partly sunk into the wall, were anciently used in Grecian architecture when the portions of the wall between them were constructed of earth, or any other weak material, for the purpose of strengthening the building. Reason points out this as being the proper use of pilasters, and therefore they ought not to be used when the main portions of the wall are constructed of strong materials, such as squared stones. In brick walls, pilasters are admissible for this reason, that these walls may be, and often are, built so thin as to require support, and at the same time thick enough for excluding atmospheric changes, in so far,

from the interior of a building. Where pilasters are used, they should appear to support a wall-plate of similar materials with themselves, projecting over the weaker and thinner portions of the wall.

Ornaments are misplaced when merely stuck on walls at random. The main parts of a building, viewed as an architectural object, are those that require most strength, such as lintels, arches, and wall-plates, and those that are most useful, such as doors, windows, verge-boards, and chimneys; and on these are ornaments most worthily bestowed. Sign-boards, and other objects that mark the use of particular buildings, are most in character when they belong to these buildings in an architectural sense, and are not merely stuck on the walls.

On Cottages as Objects in Landscape Scenery.

Cottages form the most numerous class of the various kinds of buildings that appear in rural scenery. Wherever a traveller goes, in an inhabited land, he meets with cottages, or views them in the scenery around him. Immediately after his leaving the spacious streets of a British city, and passing those suburban villas which owe their lately received existence to the prosperity of commerce and the progress of manufactures, cottages, ancient and modern, and of different sizes and characters, begin to appear as the traveller surveys the surrounding landscape. They become, as he progresses in his journey, the main artificial features in the scenery. Baronial mansions rise here and there at the distance of miles from each other, and away, on the brow of a rocky eminence, an ancient castle may be seen—

"Embosomed high in tufted trees—"

and reminding him that he is in a land that has been long inhabited, and not in a country lately reclaimed from nature by the exertions of emigrants from other climes. But cottages appear in every direction. Here is the farm-house, the highest in the class, which rears its roof above the economical buildings behind it; and there are the farm cottages, clustering together at a short distance from the homestead, each possessing, in common with the farm-house, its garden and its green. And yonder are the roadside cottage, and the country inn with its swinging sign-board, and the sweet rural village with its scattered groups of cottages, its orchards and gardens, its smiling meadows and shady lanes, enlivened with cattle and sheep, and its meandering rivulet, which is ever associated in the observer's mind with ideas of cleanliness and health. The character of a district is written in the expression of its cottage dwellings. Even in the

thinly inhabited plains and forests of the New World, the traveller remarks and notes down the appearance of any dwelling-house he may see, whatever else he may forget to record in the pages of his memorandum-book. Here is the neat little log-house, with its large and commodious barn standing behind it, in the midst of a well cleared and cultivated lot of ground. This house was built by some industrious settler who was content with scanty accommodation for himself to begin with, but has found it necessary to erect a large barn wherein to store the produce of his farm; and he will soon be able to erect a two-storied log-house, more in keeping with the size of his barn. But a little farther on, in the midst of a half-cleared lot, there appears a large unwieldy frame-house standing in front of a diminutive looking barn; its windows broken and patched, and its stack of brick chimneys beginning to part company with the less durable portion of the building, which has lurched a little to leeward, and has left an unseemly gap in the gable-end. This house was built by an ambitious settler, who paid little attention to his farm, but wanted to begin with a splendid house, that he might have an appearance of being wealthy; and now he has lost heart, and is allowing both house and farm to go to decay. Such remarks as these a passing observer might be expected to record in his note-book.

Since, then, cottages form an index to the character and condition of a country, their general improvement becomes surely a national concern, and should be promoted both by philanthropists and patriots. The philanthropist will further cottage improvement for the sake of the comfort and well-being of cottagers; and the patriot will endeavour to do so for the sake of his country's apparent character.

Fancy Cottages.—In the grounds of a baronial residence there are generally two classes of fancy cottages. The first class includes the dwellings of stewards, gardeners, foresters, gamekeepers, and other servants attached to the place, and which are commonly erected in an ornamental style. The other class comprehends such erections as hermitages, summer-houses, boat-houses on lakes, aviaries, dairies, and similar buildings, not intended for human dwellings. Different kinds of style may be employed in the erection of these various buildings; but in no single building should two different styles appear. A Swiss cottage ought to be a Swiss cottage throughout, and a Gothic cottage will look awkward under a far projecting Italian roof.

As a general principle, the cottages built as appendages to a villa or mansion, ought to partake of the same architectural character with the building to which they belong. Thus, a lodge to a Grecian villa gives a stranger some idea of the villa's architectural character, by presenting to view Grecian lines and forms

similar to those in the larger edifice. But cases may occur wherein it is advisable to depart from this rule. Repton, in the course of his practice as a landscape gardener, once considered it proper to recommend the building of a Gothic entrance lodge to a Grecian residence, for this reason, that the mansion was nowhere seen from the public road; whereas, an old ruinous Gothic castle, which gave its name to, and formed the leading feature of the place, was seen far and near by passing travellers.

When grounds are varied and extensive, ornamental cottages differing in style from the mansion, may be erected in certain situations where they and the mansion cannot be both seen in the same view. A Swiss hermitage may be erected in a situation where it will be backed by rugged precipices and straggling larch-trees, and approached by a rustic wooden bridge thrown across a ravine; and an old English cottage may be erected in some quiet secluded spot in the policy grounds of a Grecian villa.

In a shady valley within the beautiful and much celebrated grounds of Hawkstone Park, there "was placed a low building, constructed with sticks and reeds, the model of which was taken from one of the plates in Captain Cook s voyages; the inside was fitted up in a correspondent manner with the outside; while bows and arrows, horns of animals, idols, masks, caps of red feathers, shell necklaces, and two cânoes, with several *Otaheitean* plants growing at the door, distinguished the climate, and the manners, and occupations of the inhabitants," of Otaheite. (See *The Hawkstone Guide*, p. 35.)

Such objects as the Tahitian hut, in Hawkstone Park, bear the same relation to original architectural designs which portraits of individuals bear to historical paintings. They exhibit an inferior style of art, and therefore should not be brought too prominently forward in scenery. In the retired "shady valley" at Hawkstone, the hut of reeds and sticks formed an agreeable episode in the description of the place, and produced a pleasing variety in the train of ideas that ran through the observer's mind while walking over those magnificent grounds; but had the hut been erected close by, and full in view of the splendid mansion-house—the leading feature of the place—it would have been incongruous and out of place in the estimation of every person possessed of a rational and discerning taste.

It was formerly the custom to build low-walled, steep-roofed, and miserably small lodges at the gates of the most splendid residences. The designers of these eyesores seem to have considered that the contrast produced between meanness at the commencement and splendour at the termination of an approach

road would tend to heighten the effect of that splendour; forgetting that first impressions are always the most lasting; and that the first impressions received in visiting a strange residence are produced by the appearance of its entrance lodge and gates—unless the house itself happen to be seen from the public road, before the lodge and gates come into view. In no case, however, should a mean entrance be formed to a place which has the least pretence to magnificence. The lodge and the gate may either be separate objects, or they may be architecturally united. The practice of forming "boxes," or little cottages of equal size and form on each side of a gate or archway, shows a childish love of sameness, rather than a rational attention to the principles of symmetry.

As cottages for servants are essential to the completeness of a baronial residence, it shows bad taste to hide them from view by any means whatever. A mansion with no cottages within sight of it looks gloomy and solitary, and a country seat never appears so cheerful as when it is placed in the vicinity of a sweet rural village, and has snug cottages scattered here and there in its grounds. Cottages are sometimes put down in certain situations by rational landscape gardeners for the sake of their scenic effect.

To improve a dull view from a drawing-room window, Repton once placed a cottage in an adjoining park, bounded by a mass of plantation. The cottage, when viewed from the windows of the house, appeared to be, what it really was, a woodman's dwelling belonging to the grounds.

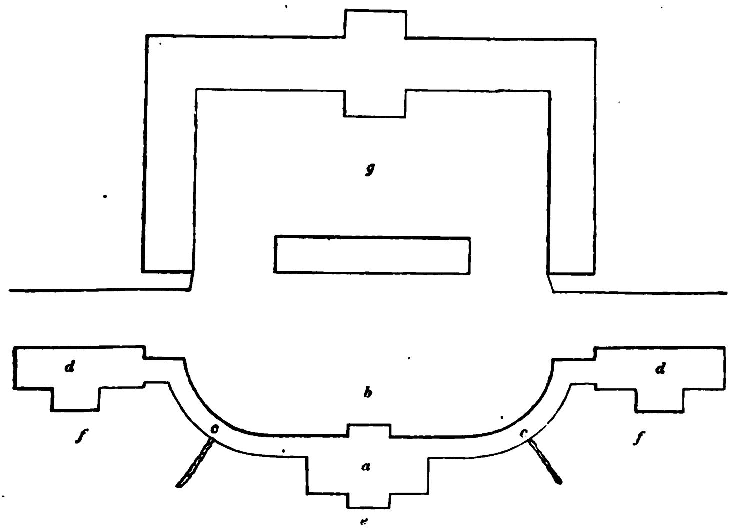
Detached Rural Cottages.—There are two main principles which may be observed in the construction of detached cottages. The first is, that they should present pleasing elevations on all sides. There are very few cottages indeed which look equally well from every point of view. Designers seldom pay particular attention to the arrangement of any elevation excepting that which is called the "front." Street houses cannot have more than one or at most two fronts. Detached dwelling-houses ought to have four. The second principle alluded to is this: detached buildings ought to be placed so as the sun will shine at times on all their four sides. There can be no proper reason assigned for building rural dwellings parallel to the public roads which may pass them, irrespective of aspect. Buildings look best when seen in angular perspective. Yet we often see houses twisted about, to the destruction of amenity in the surrounding ground lines, for the sake of having one front parallel to a road. It is recommended in Loudon's *Architectural Encyclopædia*, that the diagonal line of a ground plan be always in the direction of north and south, so that

all the four sides of a building may have at times the benefit of sunshine. Were this very simple rule every where enforced in the construction of new cottages, rural scenery, in as far as cottages are concerned, would, in course of time, undergo a pleasing alteration.

Farm-houses and Cottages.—There is a great difference of style prevailing at present in these two classes of farm buildings. An improved description of farm-houses has sprung up in the country. Farmers are now lodged in houses, which lairds in former times would have been proud of. But while farm-houses have been undergoing improvement, the condition of farm-servants' cottages has remained stationary. At the distance of two or three hundred yards from splendid new farmeries, may frequently be observed groups of miserable looking cottages, set apart as the dwellings of ploughmen and their families.

It would be a great improvement on this state of things were the cottages of farm-servants to be in themselves improved, even though they were allowed to remain as distant objects from the farmeries to which they are attached. Utility and convenience,

Fig. 9.



however, unite with taste in saying that all the buildings of a farm, including the farmer's house, the homestead, and the servants' cottages, should form one connected group. When ploughmen

live at a distance from the homestead, they cannot pay proper attention to the wants of the cattle and horses under their care; neither can the farmer have all parts of his establishment at all times under his observation. The landscape gardener desires that farm buildings should form one group, that they may all unite in producing a harmonious *whole*, the farmer's house being the central and leading object.

In fig. 9, is shown in outline the ground-plan of a farmery proposed to be arranged after the *grouping* or *harmonious* system. The farm-house, *a*, forms a central object in the group. There is a back-court, *b*, which separates the dwelling-house from the steading, and communicates with the lines of outhouses, *c c*. There are two double cottages for farm-servants, *d d*, each forming a wing to the farmer's house. The farmer's garden is shown at *e*, and the gardens of the cottagers at *f f*, while *g* indicates the position of the economical buildings relatively to that of the human dwellings. By a proper disposition of trees and shrubs, the farmer may produce complete privacy in the garden front of his house. In forming plans of this kind, the relative position of the cottages may be varied in many ways. It is intended that the cottages and farm-house shall be built nearly in the same general style, and of like materials. The circumstance of the farmer's house being of two stories, while the cottages are only of one, will give it that necessary consequence and dignity which belongs to it as the principal part of the group. It appears also to be most in keeping with the principle of consistency, to form the economical buildings of like materials with the dwelling-houses; the only difference of style in the group being, that the finishings of the cottages may be of a simpler nature than those of the farmer's house, and the finishings of the economical buildings simpler than those of the cottages.

The gardens attached to farm-houses are often allowed to remain in a state of disorder and neglect. Some farmers boast of their ignorance regarding the subject of gardening, and in most cases, if farm-house gardens are looked after at all, it is in consequence of a taste for flowers existing in the minds of the ladies of the farm-house—the farmers' wives and daughters—to whose sole exertions farm gardens often owe any attractions which they may possess. It is difficult to account for that distaste for gardening pursuits which exists in the minds of farmers themselves. Agriculture and horticulture are kindred sciences: indeed, they may be considered as one united science, for farming is only gardening on a large scale. In a garden, the operations of culture are carried on within a small space of ground, and are applied to a great variety of objects; while on a farm these same operations

are carried on more extensively as regards space, and are applied to great masses of objects similar in kind. The garden attached to a well-cultivated farm, ought to exhibit the arts of culture in as concentrated, and in nearly as perfect a degree, as possible. When once the principles of agriculture are better understood by farmers, and the mere routine of the art less depended on, they will not consider themselves happy without proper gardens, wherein they may not only raise vegetables and flowers, but also try experiments on the culture of plants on a small scale, before extending the practice of new operations in the art of culture to their farms.*

The principles of landscape gardening may be applied to the grounds surrounding a farmery in various ways. Farm-buildings may not only in themselves be rendered beautiful and pleasing, but, by the aid of trees, shrubs, and water, an amenity of appearance may be conferred upon them which they seldom possess—and this at no expense of ground. A sheep-walk beside a farmery may be so planted with scattered groups of evergreen and deciduous trees and shrubs, as to exhibit all the beauties of a lawn, and, at the same time, afford all the comforts and conveniences of shelter. A pleasingly artistical character may be given to those pieces of water which are necessary about a farmsteading for driving machinery, and affording refreshment to horses and other live-stock. By intermingling trees, chiefly oaks, with thorns and honeysuckles in the sheep-walks and gardens, and by surrounding the economical buildings with beautiful hedge-rows, a farmery, in itself convenient and commodious, may be rendered in every sense complete.

Those who wish to study the details of a complete and ornamental farmery, in which gardens, sheep-walks, ponds, dwelling-houses, and economical buildings are harmoniously combined, may find the detailed plan of one that was designed and built by the late J. C. Loudon, in the county of Middlesex, in the year 1810, by turning to page 681 of Loudon's *Encyclopædia of Agriculture*. There is one appendage to the farm-house in this design, which many farmers would willingly dispense with. It is a small green-house, or plant cabinet, which may be observed at the end of the house in the given elevation. This greenhouse

* The reason why farmers take little interest in horticulture, is perhaps this:—The mental faculties cannot for a lengthened period be strained after one object. The farmer who has been all day in his fields finds little relaxation in employing his leisure time in a garden; for horticulture and agriculture are pursuits too much akin to afford that variety which the mind of man demands. Artisans and mechanics, on the other hand, are noted for their love of gardening. The flower-plot affords agreeable recreation to him who has just come from the workshop.

was erected because the occupier of the farm, being equally celebrated as a horticulturist, botanist, and agriculturist, considered such an appendage as necessary to his enjoyment of life.

Villages.—A great variety of style and character may be given to the different cottages that compose a rural village. Tradesmen's cottages may be so distinguished by peculiarity of style and construction, as to render the employment of sign-boards, to indicate the profession of their owners, unnecessary. The shoemaker's house may be marked by a projecting stall; and the tailor's by a lean-to, with sloping glass for the sake of throwing perpendicular light upon the bench. The joiner and house-carpenter's shop may be built in the half-timbered style; and the finishings of the blacksmith's house may be in ornamental iron-work. It is desirable to dispense with the use of sign-boards in quiet rural villages; they remind the observer too much of the crowd and confusion of cities. A village grocery-shop has no use for a sign-board when it possesses a neat projecting bower-window,* filled in an attractive manner with specimens of the goods contained in the interior.

A village built on a regular plan, with straight streets and long rows of cottages, has a less pleasing effect than one which has sprung up irregularly, and is formed of scattered groups of cottages, standing singly and in pairs—each dwelling, or group of dwellings, being surrounded by orchards, gardens, and meadows. In different parts of Great Britain there may be seen cheerful and picturesque villages which have sprung up by degrees, and are consequently arranged after no regular plan. These irregular villages form excellent examples for general imitation to those who intend to lay out new villages, or groups of detached cottages. The houses in every village must of necessity differ in size and general character, but none of them should want the agreeable and useful accompaniment of a garden, whether it be large or small. In villages where each cottager possesses a garden, along with a taste for gardening pursuits, the human character is elevated in its tone, and ale-houses are fewer and less frequented than in those formal villages, built on a regular plan, where every inch of ground is feued at a dear rate, and where gardens are attached to only a certain class of dwellings.

The following description of a beautiful village, existing in a certain part of England, has been given by a writer in a provincial newspaper:—

The buildings embrace houses of almost every calibre, from the spacious arm-house to the humble cottage, and they are distributed with admirable skill;

* Commonly, but erroneously, termed a *bow-window*.

some on the level ground at the mouth of the dell, and others on gentle declivities, while not a few overhang the brow of a precipice, or occupy a snug position that has been excavated out of the solid rock. The buildings are entirely of stone, except where enriched wooden gables or other ornamental carvings have been introduced; and they present a perfect compendium of all the prettiest styles of cottage architecture, from the sturdy Norman to the sprightly Italian.

Were such a description as this applicable to all the villages in Britain, how beautiful would the face of the country appear!

On the Formation of Suburban Villages.

One of the many advantages which it is in the power of railways to confer on mankind, will be, after their further extension and improvement, the facility wherewith mechanics, artisans, and workers in factories, can be conveyed from their future residences in suburban villages to their places of work in the heart of large towns.

When violence and wickedness, unrestrained by the laws of religion, and unmodified by the practices of civilisation, increased on the earth, and when, in consequence, the members of the human family found it unsafe to dwell in tents and separate houses, the building of cities was resorted to, that different tribes and families might live together for the sake of mutual defence. The first person who built a city was, at the same time, the first member of the human race who had to flee before his fellow-men to escape the vengeance due for the crime of murder.

Primitive cities, it is thought, were but rudely though strongly fortified. The cities of the Canaanites, in the time of Moses, were so numerous, when compared with the population and size of the country, that some of them must have been very limited in extent. Many of these cities may only have been villages containing a few houses, and fortified by a surrounding ditch and raised bank of earth. The larger cities, such as Jericho, had high and strong walls.

It may have been this necessity of living close together for mutual protection that led men first to invent staircases, that they might be enabled to construct and inhabit houses of more than one storey. In ancient cities, as well as in eastern cities of the present day, the streets were formed narrow and the houses high. This crowding together of dwellings not only was convenient in the formation of fenced cities, but, from the narrowness of the streets and the height of the dwellings, an agreeable shade, in a hot and sultry climate, was obtained by the inhabitants. In some eastern cities at the present day, the streets are not only built narrow, but the upper storeys of the houses are made to project over them, for the sake of shelter from the rays of the sun.

The manner of besieging cities was a principal part in the education of an ancient warrior. In the science of modern warfare, the fortification and besieging of cities are of secondary concern.

In modern times, men live together in crowded cities, not for combination in the practice of war, but for co-operation in following the arts of peace. Manufactured goods for carrying on trade and commerce were formerly produced by manual labour in separate families, and in scattered fragments. Now, however, these goods are produced in masses by machinery and an economical division of human labour. This system of co-operation in producing goods for sale, requires that large masses of individuals should live in positions from whence their places of labour shall be easily accessible. Thus the crowded lanes and streets built for safety in time of war, are now densely inhabited for the sake of convenience in time of peace.

It is unnecessary to dwell on the moral and physical evils to which those are liable who are forced to dwell in the close and ill-ventilated lanes and alleys of crowded cities. The revelations of existing but unthought-of misery and wretchedness to be found in such places, which have been made through the instrumentality of poor-law and sanitary reporters, sound loudly in the ears of the philanthropist, and call on him both to devise and execute means whereby these evils may be remedied. The various plans which have of late been put forth for the benefit of the poor in large towns, show that this call has not been made in vain.

The facility of transport from one place to another, afforded by improvements in railway travelling, renders it no longer necessary that human beings should live close together for the sake of co-operation in works of art. Railways, to a certain degree, annihilate space, and bring places close together which were formerly separated, in reference to time, by a distance of many miles. What cabs and omnibuses formerly did for wealthy merchants, railways will soon do for mechanics and factory labourers. Had such conveyances as hackney coaches never been invented, the suburbs of our large cities would not have been adorned by the many villas which have of late sprung up for the use of merchants who had to spend a great portion of each day in their shops and counting-rooms, and wished, at the same time, to possess dwellings for themselves and families which would have all the advantages peculiar to country residences. One step in the progress of locomotive improvement caused the erection of suburban villas, and the formation of suburban gardens, for the use and enjoyment of the wealthier inhabitants of towns. But this step—the invention of hackney coaches—afforded no benefit

to the poor artisan. He had still to live, both day and night, in the unwholesome atmosphere of the narrow lane. He could not spare from his hard-won earnings the fare which a cab-driver would have demanded for conveying him to his labour morning after morning, and from it at night, had his place of residence been, like that of his employer, removed to the suburbs. Co-operation, in providing the means of railway transit, will soon enable the artisan to live in his country-house at night, and attend at his workshop in the heart of a large town in the day-time.

Of late, it has been proposed by philanthropists, and will likely soon be put in practice by joint-stock speculators, to build sub-urban villages in the neighbourhood of large manufacturing towns, for the accommodation of those families the members whereof are engaged in factories and town workshops, and who are now compelled to live huddled together in the most crowded and unhealthy parts of cities. When once such alterations and improvements in the modes of town life will become general, the days of unhealthy and close-built lanes will have passed away. The formation of suburban villages will form an era in the history of social improvement.

It has been proposed to attach a sufficient portion of garden ground to each cottage in the suburban villages that may be built. If only ten cottages are built on each acre of ground, there will be sixteen poles belonging to each cottage, including the space that the cottage stands on. This extent of garden ground will be sufficient for growing a supply, for an ordinary family, of all the finer kinds of vegetables. The cottages for families may be built singly, in pairs or in groups of three or four together; but it is to be hoped that those architects who may design and lay out the villages, will forget for a time that they were ever designers of streets or of formal rows of houses, and lay aside any prejudices they may have formerly entertained in favour of straight streets, and the placing of houses always parallel to neighbouring roads, in whatever direction these roads may run. Formal looking villages in the neighbourhood of towns, are in a similar position to that of those of the human race who endeavour to ape the manners and customs of their superiors, and at the same time completely fail in doing so. A suburban village, composed of straight streets and formal rows of cottages, will appear in the eyes of a stranger as having been originally intended for a town, the builders of which, after having laid out the streets and built the lower storeys of the houses, found themselves deficient in funds, and so had to stop the building of the walls, throw roofs over them, and turn the proposed street houses into cottages.

Combined dwellings for the use of unmarried workmen will likely form part of the proposed villages. These kind of dwellings may be erected very economically. In the *Mechanics' Magazine*, vol. xvi., there is given a design, by the late Mr Loudon, of a college for single working men, square in the ground plan, and each floor containing eight distinct dwellings, every dwelling consisting of a living-room twenty-one by thirteen feet, a sleeping room, ten feet by seven, and also a washing-room with sink and water-closet. The building was to be of a cubical form, with a continual staircase, and gallery communicating with each floor, in the centre. The whole building, as we are informed in Loudon's *Encyclopædia of Architecture*, first Additional Supplement, page 1150, was proposed to be heated from one stove at the bottom of the stairs; and in each separate apartment were to be placed two jets of gas for cooking and one for lighting. In such combined dwellings single men might live both comfortably and economically.

Much variety in architectural style may be displayed in a suburban village containing combined dwellings, single and double cottages, churches, chapels, halls, and schoolhouses.

The railway station will form a marked feature in each suburban village. As it is to its line of railway that each particular village will owe its existence, every thing connected with that line should be brought forward in a conspicuous manner. In a village of an ordinary size, the station may be centrical to the houses, but in an extensive and oblong village the station will require to be at the end farthest from the town, and the morning and evening trains which convey the labourers to and from their work, can be made to move slowly while proceeding up or down the centre of the oblong, so that passengers may be taken up or set down at different places. Once out of the villages, the trains will convey the cottagers to their places of labour in a very short space of time.

ON THE PROPERTIES AND COMPOSITION OF GOOD TILE CLAYS.

By James F. W. Johnston, F.R.S.S.L. and E.

At the present time, when a large sum of money is about to be expended in draining the surface of this and the sister island, the attention of landed proprietors and their agents is naturally drawn to the subject of *tile clays*.

What are the physical or mechanical properties by which a good tile clay is distinguished? What is or ought to be its chemical composition? There are few persons, perhaps none, in the island who are at present able to give a full and satisfactory answer to both of these questions. This arises from the circumstance that the chemical part of the inquiry has scarcely been at all investigated; while the physical properties which are *essential* to an available clay have been little studied, in their widest sense, except by a very few of our most talented practical men.

It is believed by many that available tile clays are not to be met with in districts where I am satisfied they will hereafter be abundantly found. And this because the persons who have sought for them, have formed an idea beforehand as to the qualities of a good clay, which are by no means correct—that is, they have included in their idea certain properties or qualities which are not essential to their usefulness.

Some, again, think that certain mechanical properties in the clays they meet with will be not only difficult, but too expensive, to be economically overcome; while, in reality, a better knowledge of methods and estimates, would show the contrary to be the case.

None of our practical men, as I have said, know what ought to be the chemical composition of a good clay for tiles in general—for tiles of this or that form, or size—or fit for burning in a kiln of this or that construction. Much, however, depends upon this composition, both in reference to the economy of the original manufacture, the permanency of the tile when made, and the saving of after-waste, which, in some tile-works, amounts to as much as 20 per cent of all the tiles made.

I propose, in the following article, to explain, as far as I can, both the physical properties, and the chemical composition of tile or brick clays, of different degrees of excellence.

I.—OF THEIR PHYSICAL OR MECHANICAL QUALITIES.

These refer chiefly to the fitness of the clay for immediate or future moulding, by hand, or by this or that form of machine—to its tenacity or adhesiveness when moulded—and to the greater

or less readiness with which the newly made, unburned, tiles dry, when placed in the drying sheds.

§ 1. *Mechanical qualities of a good tile clay.*

a A tile clay of good or *fine* quality, as it is called by practical men, should be free from stones, especially from bits of limestone, chalk, and coal. This quality is not indispensable, or essential to a useful clay, as methods are now known by which the stones may be economically got rid of; but in a clay of the best quality, they ought not to be found.

b It should be what is called a *strong* clay. If not already unctuous, it should become so by wintering, puddling, and working with the hand or otherwise. Without a sufficient degree of tenacity, the clay will neither mould well, nor will it cohere, so as to bear handling and carrying from place to place in the drying sheds or in the kilns.

c It should contain a certain proportion of sand. Without this it is found, in practice, that some very strong clays refuse to work economically. Much, however, depends upon the method of making the tiles. A clay which, for moulding with the hand, requires, or is improved by the addition of one of sand to three of clay, can often be easily made into tiles by machine, without any addition of sand whatever. This implies a great saving of time and labour, and is one of those numerous collateral advantages attending the use of machines, from which arise the great diminution in the cost of manufacture, wherever they are introduced.

Where thick heavy tiles or bricks are made, however, the use of sand is often beneficial with another view. When too tenacious, they are slow in drying to the heart; are thus liable to be put into the kiln before they are ready, and therefore crack in the burning. For a similar reason, what is called *muddy* clay, often cracks when it is placed in the kiln. An admixture of sand increases the porosity, and facilitates the drying throughout.

In the neighbourhood of London, the strong clays are washed and mixed with chalk for making into bricks. This not only facilitates the drying, but tends also to lighten the colour, to make them easier and cheaper to burn, and, when burned, to render them more compact and sonorous, and to give them a finer skin. In proportion to the quantity of chalk, must be the care in constructing the kilns, and firing the bricks. The reason of this will be explained in a subsequent section.

d A clay of *fine* quality should be homogeneous or uniform in appearance, as this involves less trouble and expense in mixing. It should also be compact and dense, and should con-

tain little ochrey matter. A clay may be very red, and yet be of excellent quality, but the presence of the yellow ochrey matter, such as deposits itself in many of our drains and ditches, from waters which contain much iron, involves the necessity of a more careful puddling, pugging, or mixing of the clay, and is sometimes also attended with inconvenience in the burning. This arises from the circumstance, that the ochrey deposit in question is a combination of the oxide of iron, with a large proportion—often as much as 10 to 25, sometimes even 40 per cent—of organic or vegetable matter. (It is chiefly what is called by chemists a crenate of the peroxide of iron). In the kiln this vegetable matter burns away, and either tends to split the tile, if not sufficiently porous, or to add to its porosity when burned, so as to render it more liable to injury from the frost, or to reduce the iron in the clay to the metallic state, from which undesirable after-consequences may follow.

e Lastly, in the dry state, a good clay should cut smooth and *glatty* with the knife, and should have a fat or greasy feel, and, under the microscope, should not show any large proportion of sandy particles.

To allow of profitable employment in the manufacture of tiles—that is, to pay the cost of machines, sheds, &c., and to afford the prospect of a fair remunerative profit before it is exhausted—a bed of such clay should be at least three feet in depth, and should have an extent of not less than two or three acres of a surface area.

§ 2. *When and why clays require to be puddled or worked in the pug-mill.*

Few clays are formed in such a state, or of such a quality, as to admit of their being used at once, or as they are dug up, for the manufacture of either tiles or bricks. They must, in general, be puddled or pugged, and in most cases wintered also. One important economical advantage obviously attends the use of such clays as can be dug up and manufactured without loss of time or expenditure of after-labour in turning and watering.

a Our best alluvial clays, which are often of first-rate quality, consist, in general, of alternate layers,—thin, fine, tenacious—placed upon each other regularly like the leaves of a book, and often capable of being distinctly separated as the clay begins to dry. These layers not unfrequently consist of clay of different colours and qualities, and they are always parted from each other by a thin division of sand, usually very fine, and sometimes micaceous. An alluvial clay of excellent quality from the banks of the Clyde at Corehouse, near Lanark, put into my hands by

Mr Stephens, exhibited, as it dried, a beautifully striped appearance on a smooth cut face, owing to the alternate streaks of blue and nearly white clays of which it consisted.

Such clays are not homogeneous. They would fall to pieces in drying, were they to be manufactured as they are dug up; or if they cohered in the drying the different qualities of clay would fire differently in the kiln, and would thus give a produce of tiles in which there would be great waste in the hands of the manufacturer, or which would suffer serious injury from the action of the weather. It is obvious that a complete intermixture of the clays with each other, and with the sand, is necessary to secure a requisite degree of uniformity in the substance of the whole mass.

b The same applies also to clays which are mixed with particles or streaks of sand; or which are spotted with particles of various colours; or which are full of *nibs* of hard clay, or of the rock from which the clay has been formed.

c Mixing is also necessary for the purpose of improving clays which are too fat or fusible, or of making available such as are of inferior quality and could with difficulty be used alone. A bed of two feet of a better clay may occur above one or two feet of an inferior quality. By the admixture of the two a good workable clay may be obtained, which the employment of a machine may convert into excellent tiles, and upon this mixing the hope of a profitable use of the bed of clay may entirely depend.

d When the clay, as it is dug up, is too dry for use without an artificial admixture of water, the use of the pug-mill economises both time and labour.

A clay that is homogeneous, consists of finely divided particles, is without hard nibs or beans, is unctuous, plastic, and yet free—such a clay may be formed into tiles without a previous passage through the pug-mill. Some alluvial clays are of this description. The clay of Cuttlehill, near Dunfermline—an alluvial clay or silt of the banks of the Forth—possesses, I am informed, these invaluable qualities. Some alluvial clays on the Tyne are said also to possess them.

[illegible] clays must be wintered.

P[illegible]ing or pugging is not enough to bring the greater number of clays into an economically workable condition. They generally require also to be wintered, or exposed to the action of the air and frost during the winter months. Some, I am told, [illegible] the making of bricks, for which this [illegible] they are to be manufactured into [illegible]

a Wintering is advantageous when the clay contains knots, nibs, or beans, which the winter frost will break down. These small hardish pieces are more troublesome than a considerable quantity of stones which can be removed by a grating or screening, as they either stick in the die of the machine or affect the permanence of the tile in which they occur.

Many of our clays are formed by the natural decay or degradation of the slate rocks, or of the beds of slate and fire clay that occur among the coal measures. Hence, among these clays fragments of the rocks themselves, more or less large and hard, not unfrequently occur. They are often soft enough to be crushed by the fingers, and yet are sufficiently hard to resist the ordinary action of the pug-mill, and to injure the texture and uniformity of the clay. Exposure to air and moisture, and especially to the alternation of temperature common to the winter months, softens or breaks down the fragments, and causes them to disappear in the body of the clay. The same causes act in a similar way upon particles of chalk, with which, in some of our southern counties, the clay abounds; and where these chalk nibs are present, the process of wintering is even more necessary than when the hard bits consist of fragments of the rock from which the clay has been derived.

This is owing to the way in which these several substances are acted upon by the heat of the kiln in burning. The nibs of shale or slate-rock either harden into stones which remain imbedded in the clay, with perhaps little attachment to it, or they are more fusible than the mass of clay—melt more, therefore, in the same heat, and in cooling are liable to contract differently from, perhaps more than, the rest of the tile, and thus to cause it to crack. In this way they give rise to waste.

The pieces of chalk, again, are burned into caustic lime by the heat of the kiln, and their outer surface melts more or less completely into the surrounding clay. When taken out of the kiln, the rain or moisture of the atmosphere is absorbed by the porous tile, and comes in contact with the caustic lime, which slakes itself, as it is called, increases in bulk, and by the swelling, either forces off a splinter or scale from the surface of the tile or causes it to split altogether. Thus while particles of other kinds of rock *may* do damage, those of chalk or of other forms of limestone are almost certain to do injury, and to cause waste in the manufactured tiles. Pieces of chalk will yield, in general, to the mouldering influence of wintry weather, and will disappear among the clay, but pieces of hard limestone must be removed by other methods.

b Some clays again consist almost entirely of particles, still so large in size as to refuse to cohere sufficiently when treated in

the ordinary way. Yet such clays not unfrequently become sufficiently plastic after a winter's frost. Water soaks into them more thoroughly when turned over and thrown up in heaps by the use of the spade. The air every where penetrates, and more thoroughly and rapidly disintegrates them, while the frost, by crystalizing the water wherever it has penetrated, and causing it to swell and to force its little icy needles into every crevice, completes the separation of the particles which the other agencies had begun. The last mentioned action of the frost is a very important and rapid one, and it is to allow it to be fully exercised upon the clay that the beds into which it is artificially thrown up should not be above three feet in depth—at least in the case of clays on which much of this kind of action is desired or considered necessary.

Clays which occur under peat-bogs are said rarely to require wintering. I have not had an opportunity of examining, chemically, any such clays, with the view of ascertaining whether this alleged peculiarity be altogether a mechanical one.

§ 4. *How to examine a tile clay as to its physical properties.*

a If the clay be dry, break it across. Does it consist of different layers? Is there much sand between them? Is it stony? Are the stones large or small—of what nature are the stones—are there pieces of limestone or chalk among them? Are they likely to fall by the action of the weather? Does it contain differently coloured particles—what are they? The aid of a pocket microscope will be useful in reference to the last point.

The inferences to be drawn from the answers we give to these inquiries will be readily gathered from what has been stated above.

b Cut it with a knife. Is the fresh surface smooth, shining, and greasy to the touch? Does it appear, under the microscope, to contain many particles of sand or of scales of mica?

c Reduce it to powder, separating the large stones if any are present—beat it up with water into a soft mass. Is this mass tenacious and plastic? Examine,—by working it between the finger and thumb, in comparison with some clay of known good quality, or what you recollect of other clays,—what are its comparative unctuosity, tenacity, and freedom from sand. If it become moister in the hand by working, it contains much sand—if drier, [illegible] of pure clay.

[illegible] the fingers, however, is a very fallacious one. [illegible] knowledge upon this point I submitted five dif- [illegible] after they were beat up with water to an experienced

practical tile-maker, and desired him to place them in the order of their respective values for the making of tiles, according to his judgment. On the following day I had an opportunity of asking Mr Smith of Deanston to do the same, informing him that they had already been placed by a practical man. In Mr Smith's opinion, the sample which my practical friend had put last ought to have been put first, all the others remaining as they had been previously arranged.

d Break the plastic mass across, and observe if it breaks short and easily—as if its parts had little coherence—or if it breaks tough and with difficulty, as moist pipe-clay does. Examine the broken surface—noticing particularly if it is rough, with little hard prominences, or if it contain patches of different colours, indicating the probable necessity of wintering.

e Keep the beat mass moist for a time, and work it occasionally, observing if it increase in tenacity, or unctuosity, or toughness.

§ 5. *How and when stones and sand are to be removed.*

a How stones and sand are to be removed. There are three methods by which this may be more or less completely effected.

First, by screening. The machines of Scraggs, Clayton, and various others effect this easily, either in the pug-mill or in the machine itself. The great facility, indeed, with which pebbles can in this way be separated from the clay, has produced an entire change in the opinion to be entertained of the workable character, and therefore of the economic value, of many large deposits of clay which are met with both in our northern and in our southern counties. Clays, which a few years ago were pronounced by practical men to be wholly unfit for the manufacture of tiles, will now be found not only easily available, but a source of pecuniary advantage to those upon whose property they occur. As yet, however, these machines for screening are so little known, even among practical tile-makers, and their value to the country so little appreciated, that it is necessary for proprietors themselves to make a move in this matter, if their estates are to be improved, and their several neighbourhoods benefited, by a given expenditure of money, to the highest possible degree. Machines of every kind cheapen the tile by the substitution of mechanical for manual labour, and by the greater rapidity with which the article is made; but the screening apparatus enables tiles to be made in localities where no proper material was previously supposed to exist, and thus cheapens the means of draining still further, by lessening the cost of transport.

b The second method is by crushing. By passing the clay

between heavy rollers, or beneath an edge stone, limestone and other pebbles, chalk and nibs are removed, in a greater or less degree according to the closeness of the roller, &c.; but the entire substance of the stones is in this way mixed with the clay. When much chalk is present, as in the clays of Norfolk, or many limestone pebbles, as at the foot of our limestone hills, this is a disadvantage often of great moment. In general, therefore, the method of screening is to be preferred to that of crushing, while, at the same time, it is, in most localities, more economical.

Of course this remark does not apply where the clay employed is naturally so hard as to require to be crushed before it can be converted into a plastic mass, as is the case with fire clays. Near Campbelton, where no ordinary clay of good quality is supposed to exist, the fire clay found there in connexion with the oolite coal is crushed and made into tiles. This necessarily makes them expensive, and at the present time increases the importance of a more rigorous search for clay in that district, which I am certain may be found at no very remote distance.

When crushing is resorted to, it should be done previous to wintering, as in this way the whole is afterwards more effectually penetrated by the frost.

c The third method is by washing. By washing the clay in a stream of running water, all heavy particles and stones are separated, and the fine clay is alone carried away to be deposited in the pit in which the stream empties itself.

This method requires a command of water, and, as a general rule, is more expensive—at least than the screening—and is better adapted for the warmer and drier southern and eastern counties, than for the cold and wet climates of the north and western parts of the island. In the latter districts it would generally be a month or two later in the spring before the clay, when washed during the winter, would be sufficiently dry for the purposes of manufacture.

By washing, however, a complete separation of every thing heavy or hurtful is effected. A clay of very great density also is obtained, and, according to Mr Etheridge, when done upon a large scale, the cost is so small as to make scarcely any appreciable addition to the cost of a thousand tiles.

It is to be apprehended, too, that by this washing, a certain portion of the saline or alkaline matter will be removed from the clay, and that it will thus be rendered more infusible—less likely to run in the burning by mismanagement, or by too great a heating of *the kiln*.

A practical remark of considerable consequence, in regard to washing clays, has been made by Mr Etheridge. He recommends

that clays which become more unctuous by working—generally red clays, according to his experience—should not be washed, as by that process they are rendered less adhesive.

a When stones or sand are to be removed.—In regard to this point, every one will see the importance of removing pebbles, which, of whatever material they may be composed, interfere with the mechanical operations of the tile-manufacturer. From what I have already stated, also, in reference to the effect of burning upon the chalk and limestone pebbles, it will appear to be desirable that these should be removed, for the additional reason, that they will interfere with the excellence and durability of the finished tile itself.

I have, however, one remark to make in reference to the removal of sand, which appears to me to be of great practical importance. Stones or pebbles, of any kind or size, may be removed by either of the three methods above described, and it may be left to the discretion of individuals to decide by which method, in their respective localities, this removal can be most effectually and economically effected.

But where sand is to be removed, the case is different. Screening and crushing are of no use for this purpose, and washing can alone be resorted to. But hitherto, the idea of removing sand from clays by washing, as a means of improving their quality for the manufacture of tiles, has not, so far as I am aware, been thought of by practical men. My attention has been drawn to it by the circumstance, that clays have been submitted to me for examination, which, from the large quantity of sand they contained, I have found to be so void of tenacity as to be entirely unfit, in their natural state, for the use of the tile-maker.

In considering how this quality was to be overcome, two ways occurred to me,—that of mixing it with certain proportions of a stiffer clay, and that of washing the sand out of it. The latter, in most localities, is the only available one, but by the adoption of it, a stiff plastic valuable clay may be extracted from one of the weakest, sandiest, and least tenacious character.

The economic value of such a fact to the agricultural improvement of many districts, in each of the three kingdoms, will be at once appreciated. I may venture to say that, guided by a knowledge of this fact, there is scarcely a county in our islands in which materials capable of yielding in this way a sufficiently plastic clay for the manufacture of durable tiles may not, more or less, be easily found.

The introduction of these several methods of improving our clays, therefore, has brought us to this satisfactory condition,—

that *there are no clays so stony, and none so sandy, that, in favourable circumstances, may not be economically and profitably employed for the manufacture of draining tiles.*

§ 6. *Effect of drying upon moulded clays.*

It is a valuable quality of a tile clay, that, after being moulded and placed in the shed, it should rapidly dry. This property is probably dependent upon the proportion of finely divided siliceous matter which the clay naturally contains, and it is aided by an artificial admixture of sand. The clay of Cuttle-hill, to which I have already referred, is said to possess this property in a high degree.

This valuable property may perhaps become of somewhat less economical value when the beautiful adjustments and improvements in the drying sheds, ably contrived by Mr Ainslie, shall have been generally introduced. These adjustments admit, or cause the waste heat of the kiln to pass through the tile shed, and thus to effect a great saving in the time hitherto found necessary in preparing the moulded tiles for admission into the kiln. By securing a complete drying of the tiles also before they are burned, cracking in the kiln, and consequent waste, will be in a great degree prevented.

a A well made tile of good clay will lose about 15 per cent of its length when first moulded, or two inches in fourteen or sixteen, during the drying or subsequent burning. This, of course, varies with clays of different qualities. Those which contain the largest proportion of sand diminish the least in length — sometimes as little as one inch in sixteen. The shrinkage is ascertained by moulding small bricks of known dimensions, and measuring them accurately when dried and burned.

b A good clay, when carefully dried in a current of air, should not, on an average, retain more than twelve per cent of water, which it will lose on burning in the kiln. Pure pipe-clay, when dried in this way, usually retains thirteen or fourteen per cent of water, which it loses by burning. In a few varieties only it amounts to eighteen per cent. In common clays, the quantity of siliceous sand which is present lessens the proportion of water retained by them in comparison with our purer pipe-clays.

[illegible] *different clays.*

[illegible] more heat than [illegible] in the firing and in the construction of

kilns can be taken with clays of the former kind. A mixture of siliceous sand, if it will admit of it, usually enables a fusible clay to withstand a higher temperature in the kiln.

b Some clays become harder than others, when subjected to the same degree of heat. The lower the temperature at which the requisite hardness is attained, the less the quantity of fuel required to burn them. Clays of different qualities, in this respect, occur in the same bed, and hence the necessity of intimate admixture by wintering, and by the use of the pug-mill. The weather, in general, and especially the frost, acts differently upon the parts of the tile, which are of unequal solidity or hardness, and thus considerable waste may arise.

c A good well-burned tile should be dense, hard, sonorous, close and fine grained, homogeneous, and without visible stones or specks of lime. A smooth skin is not necessary, nor is the colour a matter of consequence in an article which is to be buried in the earth.

d Well burned tiles made by machine vary considerably in density. In absolute weight they vary from 1 ounce to 1 2-5th ounces per cubic inch.

II.—OF THE CHEMICAL COMPOSITION OF TILE CLAYS.

Upon the chemical composition depends the burning quality of the clay,—its more or less easy firing and fusibility,—and the texture and durability of the tile.

§ 1. *General composition of plastic clays.*

a Pure pipe or porcelain clay, is the standard with which all other plastic clays is to be compared. In its best and purest form this clay, besides water, consists of silica and alumina only. The valuable economic quality of these two substances is, that neither of them will melt when exposed alone to the highest heat we can raise in our furnaces. The same is the case with mixtures of the two in almost any proportion. Minerals are known which contain silica mixed or in combination with from 20 to 40 per cent of alumina, all of which are infusible in the fire.

In pure porcelain clays, from four different localities, these substances have been found in the following proportions:—

	Devonshire		Antragues.		Barsons.		Echassières.
Silica . .	49.6	...	71.0	...	52.0	...	49.2
Alumina . .	37.4	...	19.0	...	37.5	...	34.0
Water (combined)	11.2	...	9.0	...	11.2	...	16.4
	98.2		99.0		100.7		99.6

The proportion of silica in the second of these is very much greater than in any of the others, and yet it is very plastic, and is employed for making fine earthenware. In fact, as we shall afterwards see, a clay containing nineteen per cent of alumina may be sufficiently plastic for all ordinary purposes.

These clays all resist the fire, and refuse to melt. A tobacco pipe made of Devonshire clay, may be bent when heated in the furnace, but cannot be fused.

b Even porcelain or pipe clays are rarely so free from other admixtures as those above mentioned. The greater part contain an appreciable quantity of oxide of iron, of lime, of magnesia, and of potash or soda. Thus, three such clays from Delaware, Boulogne, and Strasbourg respectively, were found to contain:—

	Delaware.		Boulogne.		Strasbourg.
Silica . . .	72.33	...	69.42	...	66.7
Alumina . . .	16.75	...	18.00	...	18.2
Lime . . .	2.00	...	2.00		
Magnesia . .	0.07	...	3.27	...	0.6
Oxides of iron . .	1.29	...	0.95	...	1.6
Potash and soda .	trace	...	trace	...	trace
Water (of combination) .	6.84	...	6.28	...	12.0
Water (hygrometric) .	1.14	...	2.24		
	100.42		102.16		99.1

The effect of these admixtures is, first, to diminish the infusibility of the clay; and, second, to give it a brownish or reddish colour when burned. The intensity of the colour is dependent upon the proportion of iron contained in the clay, the increase of fusibility upon the proportion of these ingredients when taken together. This latter point I shall fully explain in the following section.

c The entire proportion of what is called silica, in the above analysis, is not in a state of chemical combination with the alumina. Much of it is usually mixed with the proper plastic clay, in the form of silicious sandy grains, more or less minute, or of fragments of rounded or angular quartz. In the analyses of porcelain clays hitherto published, the distinction is not usually made between these two portions of the silicious matter. And yet the reader will see that this distinction is of considerable importance, when it is stated that the uncombined or quartz portion may be separated from it by washing, as is explained in reference to common sand in a previous section, while the silica, which is in chemical combination, will float away as a constituent part of the minutely divided clay.

We are indebted to Forchhammer,* however, for the analyses of

* [illegible] 336

two porcelain clays, in which this distinction has been made. His results were as follows:—

	Aue by Schneeberg.		Morl by Halle.
Alumina	37.57	...	22.00
Oxides of iron and manganese and magnesia	trace	...	1.87
Carbonate of lime	0.31	...	0.33
Silica in combination	44.30	...	27.96
Silica in state of quartz	5.12	...	39.19
Potash	...	...	0.17
Water	13.02	...	7.43
	100.32		98.95

The first of these clays is much used in the porcelain manufactory of Meissen near Dresden, and contains only a comparatively small per-centage of quartz. The second contains a very large proportion. In the strong heat of the porcelain furnace at Berlin, this clay only bakes together a little.

§ 2. *Composition of fire or infusible clays.*

Fire clays partake very much of the chemical composition and infusible character of the porcelain clays. They occur, however, in a more or less hard state, and usually require, in consequence, to be ground to powder by machinery; but they cannot, at any reasonable expense, be brought to an equally minute state of division, and therefore, never attain the degree either of smoothness or plasticity exhibited by our better porcelain clays.

Like the porcelain clays, those distinguished by the name of fire clays differ in composition, though their principal ingredients are the silica and alumina mixed and united in various proportions. It is the small proportion of other matters they contain which gives them their peculiar value—that of withstanding or being infusible in the fire.

The following table exhibits the composition of five varieties of fire clay from different localities:—

	From Coal Island.		From Stourbridge.		From Stannington.		From Howth.		From Garnkirk.
Alumina	30.8	...	38.8	...	40.9	...	23.20	...	43.6
Silica	46.2	...	46.1	...	43.0	...	67.96	...	53.4
Peroxides of iron and manganese	8.4	...	...	...	trace.	...	1.19	...	2.4
Lime	...	...	...	...	1.3	...	3.23	...	0.6
Magnesia	...	...	...	...	0.1	...	0.63	...	...
Potash	0.4	...	...	...	...	...	...	...	...
Water	14.2	...	15.1	...	14.7	...	3.79	...	...
	100.0		100.0		100.0		100.00		100.0

Fire clays usually form a light coloured brick or tile. The

first of those in the above table would give a reddish brick from the large per-centage of iron present in it; but where, as in those represented by the second and third columns, no oxide of iron is found, it is only the expense of bringing them into a finely divided and plastic state that prevents them from being applicable to the manufacture of the most valuable china and porcelain wares.

b But fire clays from the same locality differ very much in composition. Hence the discordant results of different analyses in regard to a clay so universally celebrated as that of Stourbridge. Different varieties of fire clay are found and used in that locality, all perhaps excellent in withstanding the fire, and yet very unlike each other in chemical composition.

Thus four different authorities give the following tabular results as representing the composition of the Stourbridge fire clays examined by each of them respectively:—

		Thomson.	Berthier.	Salvetat.
Silica	46.1	72.5	63.7	45.25
Alumina	38.8	20.3	20.7	28.77
Oxide of iron	...	3.3	4.0	7.72
Oxide of manganese		1.5	...	...
Lime	...	0.9	...	0.47
Magnesia	...	...	...	trace
Phosphate of lime	...	1.5	...	...
Potash	...	...	...	trace
Water	15.1	...	10.3	17.34
	100.0	100.0	98.7	99.55

Comparing only the last two of these columns, we see how different in composition different samples of this clay appear to be. The one contains more silica and the other more oxide of iron; and though both would, no doubt, be durable clays, yet bricks made of the latter would be both redder in colour and less permanent in the fire than such as were made of the former of the two.

§ 3. *Silica, alumina, and pure clays are fusible when mixed with potash, soda, lime, magnesia, or oxide of iron.*

We have seen that silica and alumina, either alone or when mixed together, resist the action of our strongest fires. The mixtures bake or cohere, and harden, but refuse to melt.

But if silica in any form—that of quartz, of flint, or of silicious sand—be mixed with potash, soda, lime, magnesia, or oxide of iron, and then exposed to the heat of a furnace, the mixture will melt—often with great ease. The temperature at which the fusion takes place, as well as the degree of fluidity of the melted

mass, depends upon the proportion and the nature of the substance with which the silica is mixed.

All our varieties of glass in common use for windows, mirrors, bottles, &c., with the exception of flint-glass, consist of such fusible admixtures of silica, chiefly with soda and lime. In German and some other foreign glasses, potash takes the place of soda. The following table exhibits the composition of four different varieties of glass, lately analysed by Salvetat,* in which it will be seen that lime, soda, and potash are the substances employed to give fusibility to the large quantity of silica they contain:—

Composition of Window and Crystal Glass.

	Window Glass, Saint Quirin.	Phial Glass, Cerey.	Fine Potash Glass, Valerythal.	Common Soda Glass, Valerythal.
Silca	71.96	73.00	74.59	76.05
Alumina	0.67	0.20	0.51	1.02
Oxide of iron	0.67	0.10	0.27	0.63
Oxide of manganese	0.19	...	0.45	0.20
Lime	13.55	7.87	7.77	5.95
Magnesia	...	trace	trace	trace
Potash	1.70	3.26	16.41	2 18
Soda	11.00	15.49		13.78
	99.74	99.92	100.00	99.81

The small proportions of alumina, and of the oxides of iron and manganese, exhibited in the above table, are to be considered as impurities—the manganese being usually added to improve the colours. Thus these varieties of glass consist essentially of about—

Silica	71 to 76
Lime	6 to 14
Potash or soda	13 to 17

In flint-glass, litharge (oxide of lead) is employed in the place of lime. This makes the glass more easily fusible, heavier, and more brilliant.

Alumina also, when mixed with potash, soda, lime, or oxide of iron, melts in the fire more or less readily according to the proportions of the mixture and the nature of the substance employed along with it. Both silica and alumina become more

* SALVETAT, An. de Chem. et de Phys. 3e Series, xix. p. 252.

fusible when melted along with potash or soda than with lime, magnesia, or oxide of iron.

It will readily be understood, therefore, that pure clay, consisting of silica and alumina, will also melt when mixed with these substances in proper proportions. Of this property of clay advantage is taken in many of the manufacturing arts practised in this country.

Thus, in bottle-glass, clay is generally an ingredient, and sometimes to a considerable extent. Such is the case with a bottle-glass found by analysis to consist of—

Silica	60.4	Infusible, 70.8 per cent.
Alumina	10.4	
Potash and soda	3.2	
Lime	20.7	
Baryta	0.9	
Magnesia	0.6	
Oxide of iron	3.8	
	100.00	

So that silica, alumina, potash or soda, and oxide of iron are the chief constituents of this glass. It is more difficult to melt than the other varieties of glass, is made of cheaper materials, and owes its colour to the iron it contains. The purer the clay and sand the more colourless the bottle. Medicine bottles are usually made of such purer clays. Some varieties of window glass also contain as much as ten per cent of alumina.

The process of smelting our British iron ore is based upon the same property of clay. The ores in use in this country are of the kind called clay-iron-ores, because of the large quantity of clay they contain. The entire ore, when burned with little coal, and in the presence of a current of air, will often melt with great ease, because, as I have already stated, silica and alumina, mixed with a sufficient proportion of oxide of iron, will readily melt. Hence it is that when heaps of black-band ironstone, rich in iron, are burned, preparatory to their being thrown into the smelting furnace, and care is not taken by covering them up to exclude the air, the whole mass will sometimes run or melt into a black mass which is difficult to break asunder, and is afterwards more tedious in the smelting.

But when mixed and burned in the smelting furnace, with much coal, so as to reduce the oxide of iron to the metallic state, and to convert it into cast-iron, the clay remains in the furnace in a very infusible state, or, if it does melt, retains a considerable proportion of the iron. It is to melt this clay completely, and to liberate the iron, that limestone is thrown into the furnace. The lime unites with the clay, forming a

dirty fusible mass, which is allowed to flow away in the form of slag. Thus it is the property which clay possesses, of melting when mixed with lime, that enables the iron smelter, by his present process, to extract the metal from his clay-ironstones.

§ 4. *Composition of natural tile clays.*

Our tile and brick clays are usually red naturally, or become red when burned. This shows the presence of oxide of iron, one of the ingredients which tend to make them fusible. Many also contain lime—some in very considerable proportion. Magnesia is by no means uncommon, while potash and soda are always present in quantities more or less appreciable. It is the presence of these ingredients which gives to our bricks and tiles the burned, glassy, swollen, and porous appearance they occasionally present, and which, at times, in the hands of a careless or unskilful fireman, causes a whole kilnful of tiles, or batch of bricks, to run together into one melted mass.

With the view of ascertaining the relative values, and the usual composition of the tile clays of this country—of different degrees of excellence in the opinion of practical men—I have caused a considerable number to be analysed in my laboratory. Many others also have been forwarded for examination by members of the Agricultural Chemistry Association.

The results of some of these analyses I shall here present.

a The clay of Cuttle hill, near Dunfermline, was one of the first to which my attention was particularly drawn. It was represented to me, by Mr Henry Stephens, as one of the best in Scotland for making tiles; and I am indebted to Mr Burns, the proprietor, for samples of the clay, and of the excellent tiles he makes from it. It is a blue alluvial clay, which burns red, and is free from stones. Its composition, according to the careful and repeated analyses of my friend and pupil, Mr Jones, was as follows:—It was previously dried at 300° Fahr.

Silica, and very fine sand,	64.14	Infusible. 77.68
Alumina,	13.54	
Oxides of Iron,	7.57	
Lime,	1.90	
Magnesia,	1.21	
Potash,	1.86	
Soda,	0 68	
Sulphuric acid,	1.37	
Organic matter and water of combination,	7.82	
	100.09	

We see, from the above table, that this clay contains—sup-

posing the water and organic matter to be driven off by heat—about 84 per cent of infusible, and 16 per cent of fusion-causing ingredients. Some varieties of plate and Bohemian glass contain as much as 78 and 79 per cent of this infusible part.*

When treated with strong muriatic acid, the Cuttle-hill, like most other clays, is partly dissolved, and partly left behind in the form of an insoluble, nearly colourless, powder. Of course, any carbonate of lime (chalk or bits of limestone) the clay may contain, or carbonate of magnesia—any hydrates of alumina or magnesia—any gypsum, and any silicates capable of being decomposed by the acid, will be in this way taken up. The soluble and insoluble parts of this clay were found, by Mr Jones, to consist respectively of—

1. *The part soluble in acid.*

Organic matter and water of combination,	7.82
Alumina,	2.22
Protoxide of iron,	4.41
Peroxide of iron,	0.42
Lime, (combined with the sulphuric acid,)	0.97
Carbonate of lime,	0.17
——— of magnesia,	0.63
Potash,	0.90
Soda,	0.44
Sulphuric acid,	1.37
Soluble silica,	1.94
Insoluble matter,	78.76
	100.05
Water,	2.86

2. *The part insoluble in acid.*

Silica,	78.97
Alumina,	14.37
Oxide of Iron,	3.48
Lime,	0.96
Magnesia,	0.71
Potash,	1.18
Soda,	0.30
	99.97

* Thus a French plate glass, and an old Bohemian glass, were found by Dumas to consist respectively of

	French Plate.	Bohemian Glass.
Silica and Alumina	78.7	79.
Potash and Lime,	21.1	21.

Mr Jones did not determine how much of the silica in this clay was in a state of combination, which would have been interesting to ascertain, and how much in the state of fine quartz sand. When washed, the clay leaves very little sand which can be separated readily in this way; and the excellence, especially the rapid drying quality of this clay, is in part derived from the very minute state of division in which the quartz sand exists in it.

From the above analysis, it appears that the part insoluble in acid contains 93 per cent of infusible matter, and would probably, therefore, if heated alone, refuse to yield to the heat of our strongest kiln fires.

The following table represents the exact composition of the whole clay, so far as it can be made out from the researches of Mr Jones:—

Organic matter and water of combination	7.82	
Alumina, soluble in acid	2.22	13.54
——— in state of insoluble silicate	11.32	
Protoxide of iron, soluble in acid	4.41	7.57
——— ——— in a state of insoluble silicate	2.74	
Peroxide of iron, soluble in acid	0.42	
——— of manganese	trace.	
Carbonate of lime	0.17	1.90
Lime (combined with sulphuric acid)	0.97	
—— in a state of insoluble silicate	0.76	
Carbonate of magnesia	0.63	1.21
Magnesia, in a state of silicate	0.58	
Potash, soluble in acid (in a state of silicate ?)	0.90	1.86
——— in a state of insoluble silicate	0.96	
Soda, soluble in acid (in a state of silicate ?)	0.44	0.68
—— in a state of insoluble silicate	0.24	
Sulphuric acid	1.37	
Silica, soluble in acid	1.94	64.14
Silica and sand, insoluble in acid	62.20	
	100.09	

I have caused several other clays to be examined with equal care, and as minutely as this of Cuttle-hill; but, for practical purposes, it is not necessary that I should here present more than the general results.

b Clay from Sherburn Hill, near Durham.—This clay, on the property of Mr Booth, attracted my attention, in consequence of the very beautiful tiles he makes from it, the simplicity of the machine he employs, and the reasonable price, compared with those of the Scotch makers, at which the tiles are sold. The clay is blue alluvial, and somewhat stony. The stones are separated from it in the machine as the clay approaches the die. Some of these stones consist of blue limestone, showing that the clay has come chiefly from the west, and particles of it which pass through the

screen and the die, appear occasionally in the burned tile, swelling and cracking it as they absorb the moisture and carbonic acid of the atmosphere.

A piece of a burned tile, as I had none of the recent clay, was reduced to fine powder, and analysed by my pupil Mr Duke, whom fifteen months assiduous study in my laboratory had fully qualified for this duty. The general result of his examination was as follows:—

Silica,	61.09	Infusible 81.0
Alumina	19.91	
Oxide of iron	6.75	
Lime	3.36	
Magnesia,	2.38	
Potash and Soda	2.83	
Carbonic acid and loss	3.68	
	100.	

This clay, even after burning, appears to have contained a portion of lime, and perhaps also of magnesia, in the state of carbonate. This may be the carbonate originally existing in the clay, which the heat had not been sufficient to decompose, but it is more probably carbonate which has been formed by the absorption of carbonic acid from the air, or from the atmosphere of the kiln, after the tiles were burned.

If we deduct the carbonic acid, then the Sherburn clay contains 84 per cent of infusible matter; the same, very nearly, as the Cuttle-hill clay.

The portion insoluble in muriatic acid amounted to 76½ per cent., and had the following composition:—

Silica and fine sand	79.28	Infusible 96.88
Alumina	17.60	
Lime	0.42	
Magnesia	1.23	
Alkaline matter and loss	1.47	
	100.	

The burning of a clay has very considerable influence upon its solubility in acid, and, therefore, we could not expect the insoluble part of this burned tile to be exactly the same as that of the unburned Cuttle-hill clay, although the clays, as they occur in nature, had been altogether identical in composition. In this insoluble part, accordingly, though the silica does not differ much, yet there is less oxide of iron, and more magnesia, than in the insoluble part of the Cuttle-hill clay.

On the whole, however, these two clays, in economical value, approach very near to each other.

c Clay from Tullarone, county Sligo, Ireland. This is also a species of alluvial clay, of a blueish colour when wet, becoming grey when dry, tenacious when beat up with water, and cutting smooth and greasy in the dry state. It was here and there studded with ochrey spots. Examined by my assistant, Mr M'Calmont, it was found to contain only about a quarter of a per cent of sand, separable by washing, and, when dried at 300° Fahr., to consist in a hundred parts of—

Silica and very fine sand	66.16	Infusible 82.24
Alumina	16.08	
Oxide of iron	8.38	
Lime and magnesia	1.88	
Potash and soda	1.83	
Organic matter and combined water	4.89	
	99.22	

I do not give the results of this analysis more particularly, as the above table is sufficient for all practical purposes. When the water and organic matter are driven off by the burning, this clay contains 86 per cent of infusible matter, and, therefore, as it occurs in nature, will stand a greater quantity of heat than either of the clays previously mentioned.

d Clay from Argaty, Stirlingshire.—This is a blue, very plastic clay, found in a thick bed on his property of Argaty by Mr Binning Home. It is naturally blue, but burns red. It was found, when free from water, to consist of—

Silica, chiefly in a state of combination,	49.24	Infusible 78.34
Quartz sand, (separated by washing)	7.70	
Alumina	21.40	
Oxides of Iron	15.85	
Lime	1.26	
Magnesia	1.35	
Potash and Soda	3.39	
	100.19	

From the large proportion of iron it contains, this clay would be more fusible than any of the others above described. But as the per-centage of alumina is also large, the silica may be advantageously increased by the addition of ten per cent of quartz sand. By this means it will be made both freer to work, and more durable in the fire.

The large quantity of iron in this clay was probably derived from the old red sandstone, or from the trap rocks which abound in that part of Scotland.

e Clays from The Burn, Forfarshire.—Two clays were sent to me by Captain M'Inroy, from his property of The Burn in Forfarshire, with the view of ascertaining whether they were capable of being made into tiles, or could be economically treated so as to make them available for this purpose. The one was blue, the other red. Both were stony, and contained much quartz sand. The blue clay appeared to be sufficiently plastic and tenacious to be manufactured into tiles; the red clay seemed, however, to be too sandy for the purpose. As the process of washing to free a clay from fine sand had not then occurred to me, I reported to Captain M'Inroy what I do not now believe to be the case, that this red clay was not directly available for the purposes of the tile-maker. According to the analysis of my late assistant, Dr Fromberg, the two clays, when freed from stones, consisted of—

	Blue.	Red.
Quartz sand, (separable by washing)	30.30	62.50
Silica, and a little very fine sand,	35.99	12.59
Alumina,	19.29	15.04
Oxide of Iron,	7.44	5.01
Lime,	1.42	0.85
Magnesia,	1.26	1.34
Potash and Soda,	4.21	2.25
	99.91	99.58

The quartz, silica, and alumina, in the first of these, the blue clay, amounted to 85.58 per cent, and to 90.13 per cent in the red. There was little danger, therefore, of either of these melting in the fire, if they could easily be moulded, dried, and, without breakage, be transported to the kiln. The composition of the red clay, as has been represented by Dr Fromberg, is singular—the proportion of alumina (15 per cent) being greater than that of the silica (12½ per cent) in a state of chemical combination.

It was by far too sandy, however, and possessed of too little tenacity, to admit of its being moulded and handled while drying, without very great danger from breakage. But this clay seems to me now to be one of those varieties which is to be improved, —brought indeed into the condition of a clay of superior quality, —by the process of washing. In the neighbourhood of a running stream, or by means of a runner brought to the spot, this improvement might be very easily and economically effected.

f Clay from Strathallan, Perthshire.—A small sample of a clay, apparently alluvial, and free from stones, was forwarded to me by Lord Strathallan for analysis. It was found by my assistant, Mr Cameron, to consist of—

Silica and very fine sand, . . .	57.13	Infusible 79.34
Quartz sand (separated by washing,)	2.00	
Alumina, ...	20.21	
Oxide of Iron, ...	11.34	
Lime, ...	0.88	
Magnesia, ...	2.82	
Potash and Soda, . . .	2.11	
Carbonic acid, organic matter, and loss,	3.51	
	100.	

This clay, though excellent in its mechanical qualities as far as I could judge from the small quantity sent to me, appears, from the composition, to be a little less difficult to fuse than some of the others. It will require more care, therefore, in the burning, if used without mixture. We have already seen that some kinds of glass contain 78 and 79 per cent. of infusible matter: and this clay, even suppposing the carbonic acid and organic matter to be driven off, contains only 82 per cent. But it is sufficiently tenacious to admit of an admixture of sand to the amount of 5 or 10 per cent of the dried clay, and this would render it sufficiently refractory in the fire, to bear even a little neglect in a well constructed kiln.

g Clays from Kilkerran, Ayrshire. Five different clays, all free from stones, were forwarded to the laboratory of the Association, by Sir Charles Dalrymple Fergusson of Kilkerran, in Ayrshire. Analysed by my assistant, Dr Fromberg, they gave the following results:—

	1	2	3	4	5
Quartz sand, (separated by washing)	2.07	7.13	36.54	4.23	14.61
Silica, ...	55.29	52.13	40.70	53.25	48.05
Alumina, ...	25.53	24.76	13.31	29.90	18.24
Oxide of Iron, ...	6.91	9.89	4.30	9.77	6.92
Lime, ...	1.27	0.52	1.26	0.80	1.57
Magnesia.	1.90	0.32	0.83	0.12	2.51
Potash and Soda,*	6.40	4.57	2.10	0.73	6.52
	99.37	99.32	99.04	98.80	98.42

The infusible matter in these five clays, respectively, amounts to,—

* I cannot help believing that there must be a mistake in the large per-centage of alkaline matter found by Dr Fromberg in some of these clays. I shall cause the analyses to be repeated.

	Per cent.	General appearance.
No. 1.	82.89	cream-coloured, plastic.
2.	84.02	pale yellow, plastic, when dry of little specific gravity.
3.	90.55	light brown, not so plastic as 1 and 2.
4.	87.38	orange yellow, very little density when dry.
5.	80.90	darker in colour than No. 3, and more plastic.

They may all, therefore, be regarded as good clays for withstanding the fire,—No. 5 being the most fusible of the whole, and after it No. 1; No. 3 must be the most infusible, since the silica and alumina in it amount to 90½ per cent. In looking at the third column, however, in the preceding table, we see that this clay contains no less than 36½ per cent of silicious sand, capable of being separated by washing. The consequence of this is, that it has much less tenacity than the rest, and will, therefore, be the most difficult to mould and dry, because it will bear the least handling during the manufacture; still, clays even less tenacious than these, are capable of being economically manufactured into tiles.

I have already explained how a difficulty of this kind may be overcome by washing a portion of the sand out of the clay. It might, perhaps, also be avoided by causing the machine to deliver moulded tiles to an endless web, so adjusted as to deposit them, without any handling, upon movable boards or shelves, upon which they could be permitted to remain till they were ready to be carried to the kiln.

In the present instance, when other clays are at hand containing comparatively little sand, a better clay than any of them singly may be formed by mixing No. 3 in certain proportions with one of the others.

h Clay from Portobello, near Edinburgh. This is a fine blue very plastic alluvial clay, free from stones, which lies along the shore at Portobello, and is extensively used in the manufacture of bricks, tiles, chimney-pots, and other articles. The specimen analysed is from the tile-work now in the hands of Mr Livingstone. It contains some fine sand, but very little coarse enough to be separated by washing. Analysed by my assistant, Mr Cameron, it was found to consist of—

Silica and impalpable sand	53.02	Infusible 79.5
Sand separated by washing	0.93	
Alumina	25.55	
Oxide of iron	8.06	
Lime	0.68	
Magnesia	1.61	
Potash and soda	1.54	
Organic matter and combined water	8.60	
	99.99	

Deducting the organic matter and water, this clay contains 86½ parts of infusible matter in every hundred. It is in this respect, therefore, superior even to the clay of Cuttle-hill. But of these 86½ no less than 27 parts are alumina, while in the Cuttlehill there are only 15 parts of this ingredient,

This large proportion of alumina will render the Portobello clay more difficult, and, therefore, slower in drying than that of Cuttlehill. It has, however, this countervailing advantage, that it may be mixed with a large proportion of the sea-sand of the neighbourhood without injuriously affecting its tenacity, while, at the same time, its infusibility in the fire, and its tendency to dry in the air, will be proportionably increased.

Among the clays of which the analysis has already been given, three of those of Sir Charles Fergusson (Nos. 1, 2, and 4) agree in this latter character with the Portobello clay; like it, would admit of a large admixture of sand, and would thereby be improved for the manufacture of draining or roofing tiles.

i Clays from Forfarshire.—These clays were sent to me by Mr M'Nicoll, on the part of Lord Airley. They occurred on different parts of his lordship's property, and he was naturally desirous of knowing what was best in quality for making tiles generally—which for making pipe-tiles, and whether any of them could be used directly and without wintering, so that operations might be commenced without delay.

From what I have stated in the first part of this paper, it will appear that the answer to the last of these questions depended entirely upon the physical or mechanical properties of the clays. If they were full of nibs, they would require wintering, or if, having little tenacity when dry, they became more plastic by exposure to the air. If sufficiently tenacious, and free from small hard lumps, they might possibly be fitted for use by merely passing them through the pug-mill.

On careful examination, none of them, except the upper part of No. 1, seemed sufficiently uniform in texture, and free from small hard lumps, to justify the opinion that wintering could be dispensed with. All the others were not only blotched and streaked throughout, but were also full of minute hard lumps, which wintering might be expected more or less completely to remove. They possessed comparatively little tenacity—No. 1, top, being the only one which could be called fat, and of which the particles were uniformly in a state of minute division. A person accustomed to rich, fine clays would have pronounced them all inferior, and would have been inclined to reject some

of them altogether. When analysed by my assistant, **Mr Cameron**, they were found to consist of—

	1. Top.	1. Bottom.	2.	3.	4.
Silica and very fine quartz sand	66.04	60.63	64.25	71.17	61.77
Sand, separated by washing	2.35	2.30	2.21	2.98	10.90
Alumina	10.84	11.45	14.52	10.10	10.05
Oxides of iron . . .	7.13	6.93	5.89	4.09	5.93
Lime, magnesia, potash, and soda	8.76	10.66	7.49	5.90	7.56
Organic matter and combined water . . .	4.16	6.88	4.50	4.47	3.71
	99.28	98.85	98.86	98.71	99.92

The proportion of infusible matter in these several clays, therefore, omitting the water and organic matter, was as follows in a hundred parts :—

No. 1.—Top	. . .	82½
Bottom	. . .	79½
No. 2.	. . . . .	84½
No. 3.	. . . . .	88
No. 4.	. . . . .	85¾

In order of infusibility, therefore, No. 3 was the highest, No. 4 next, and then followed No. 2 and No. 1 top—while the bottom layer of No. 1 was the most fusible. This appeared to be owing to the presence of much mica, with which it glittered throughout.

This result supplied an answer to the question as to the relative fitness of the several clays for common heavy and thin pipe-tiles. The more infusible the clay the better it is fitted for light, thin articles, which will readily run in too strong a fire; and, therefore, other qualities being equally suitable, No. 3 is to be preferred for the manufacture of ordinary pipe-tiles.

The proportion of infusible matter in some of these clays, and especially in the two layers of No. 1, is about the same as is found in some varieties of glass. I was desirous, therefore, of testing the burning qualities of the five clays by actual experiment in the furnace; and I placed them, for this purpose, in the hands of the skilful manager of Mr Burn's works at Cuttle-hill. Having made a small brick of each, he placed them together in a furnace and heated them, no doubt to a high temperature; for, upon examining them, he found they had all melted into a mass of light porous matter, which, when cold, very much resembled pumice. He therefore reported to me that the clays were very bad.

[redacted]

Knowing, however, from their composition, that the best of our common tile-clays will melt if too urgently heated, I had other bricks made half an inch thick, and found them all to fire well in my own laboratory, and afterwards in the tile-kilns of Mr Livingstone at Portobello, to whose kindness I am indebted for making other experiments for me of a similar kind. At Cuttle-hill also, in a subsequent trial, in the kiln itself, a similar favourable result was obtained.

From these experiments I drew the conclusion that all the clays, if used carefully, are capable, when once moulded and dried, of burning into good tiles. At the same time, we see that even practical tile-makers may err in judging a clay to be unfit for their purpose, from the results of a hasty experimental examination.

In the case of all the other clays, nearly without exception, of which the composition has been previously given, I have stated that the infusibility might be increased by an addition of silicious sand. But in the case of these clays, that resource is not available. I have already said that they were possessed of little tenacity, and that some of them appeared to be so little adhesive as scarcely to admit of being moulded and dried without more than ordinary care. The possibility of any safe admixture of sand, therefore, seemed to be out of the question.

On looking at the table representing the composition of these clays, it will be seen that the proportion of alumina contained in them varies from 10 to 11½ per cent only—a very much smaller per-centage than is found in any of the other clays of which the analysis has been given in this paper. In this small per-centage of alumina we see a reason for the feeble tenacity of these clays in their natural state, and for their inability to bear that further addition of sand by which their infusibility might be increased. We obtain from it a chemical rule to guide us also in all similar cases.

My deductions in regard to these clays, therefore, were—

1° That though somewhat defective in adhesiveness, and tender when dried in the air, all the clays would make good, hard, sonorous tiles.

2° That only the top layer of No. 1 could, without previous trial, be recommended for immediate use when dug up. The rest appeared to require wintering.

3° That the two layers of No. 1, if wintering were adopted, might be mixed together without material disadvantage. The fusibility of the mixture would be a little greater than that of the top layer alone.

4° That Nos 3 and 4, if sufficiently tenacious in practice, would be safest to use for small pipe-tiles. All must be tenderly treated in the moulding and drying, but especially in the burning.

5° That the proportion of alumina contained in them, as well as their apparent want of tenacity, were opposed to the attempt to increase the fusibility by a further admixture of silicious sand.

k Clays from Berwickshire.—Two clays, of which the following table exhibits the composition, were sent to me from the parish of Eyemouth in Berwickshire, by Mr Milne of Milnegraden. They were massive, not alluvial clays, somewhat stony, spotted with ochre and fragments of decaying sandstone, and contained some hard lumps, but they both burned into a beautiful red pottery. Analysed by my assistant, Mr Cameron, they gave,—

	No. 1.		No. 2.
Silica and very fine sand	59.37	...	49.52
Sand, coarse, separated by washing,	10.00	...	3.80
Alumina . .	15.86	...	22.09
Oxide of iron . .	5.34	...	8.27
Lime . . .	1.54	...	2.02
Magnesia . .	4.21	...	3.34
Potash and soda .	1.36	...	1.88
Organic matter and combined water	2.18	...	7.55
	99.86		98.47

A part of the lime in these clays was in the state of carbonate, which accounts for the apparent loss on the second analysis. The larger proportion of magnesia in these clays is no doubt connected with the chemical nature of the rocks, by the wearing away of which the clays have been formed.

The infusible matter of these two clays,—the water and organic matter being removed,—amounts to 87 per cent in No. 1, and to 81 per cent in No. 2. The former clay, therefore, will stand the higher temperature in the kiln, and may be the more unceremoniously burned.

On the other hand, however, No. 2 contains more alumina and less coarse sand than No. 1. It will, therefore, bear an addition of 7 to 10 per cent of sand without becoming less tenacious than No. 1, while, at the same time its infusibility will thereby have become greater. This clay, No. 2, therefore, presents one of those cases in which sand may be added to the clay with advantage in almost every respect, and especially for the manufacture of thin and light pipe-tiles.

§ 5. *General deductions in regard to the chemical characters of tile clays.*

From the results of the analyses above detailed, taken in

connexion with the preceding observations, it appears to follow—

a That if a clay be sufficiently plastic and tenacious, the greater the proportion of silica and alumina, taken together, which a clay contains, the less fusible it is. In clays of average goodness, the proportion of these two substances, taken together, ought to be about 85 per cent. Mr Smith's experiments in making tiles from peat, show that a very small degree of tenacity is really necessary in the material of which a tile is made, when due precautions are adopted. Practical men, and especially such as have been accustomed to make tiles only by the hand, are often unfamiliar with the minimum degree of adhesiveness which clay may possess without being unfit for this manufacture. It is of consequence, however, to know this, because when only a small deposit of stiff clay occurs, it may be possible, by a large admixture of sand, to make it go very much farther than it would do if used alone.

b The adhesiveness of a clay depends mainly upon the proportion of alumina it contains. Among the clays of which the analysis has been given, those from Forfarshire contained as little as ten per cent. of this ingredient; and as these clays were far from being tenacious or fat, perhaps this proportion may be considered as approaching to the smallest which can exist in a useful clay. Some we have found to contain as much as 30 per cent., though the average proportion in what may be called good clays is probably from 17 to 20 per cent.

c Much, however, depends also upon the state of division in which the silica exists. The coarser the sand, the freer and less tenacious the clay. If the silica, though not in a state of chemical combination, be very minutely divided, a much greater degree of adhesiveness will be exhibited than the proportion of alumina taken alone would indicate. The fatness of a clay depends conjointly upon the per-centage of alumina, and the fineness of the silicious matter. The less the proportion of alumina, and the coarser the sand, the freer will be the clay, and the more rapidly will it dry in the air.

d The clay in which the proportion of infusible ingredients is greatest, other properties being favourable, is best adapted to the manufacture of thin pipe or other forms of tiles.

e The more lime and oxide of iron clay contains, the more fusible it is, but the more easily, also, and cheaply it can be fired. A small addition of lime (fine chalk) to a very infusible clay will facilitate the burning, and lessen the cost; while, at the same time, it will render the tile more compact, and give it a smoother skin.

It is probably in this way that the admixture of chalk is found beneficial by the brickmakers in the neighbourhood of London.

§ 6. *How to designate and to increase or diminish the fusibility of a natural clay.*

a In the preceding part of this paper we have seen that pure infusible pipe-clay, when the water is driven off, contains silica and alumina only. Its infusible ingredients amount to one hundred per cent. As this per-centage decreases, so does its infusibility. The simplest way of designating the fusibilty of clays by numbers, therefore, is to represent that of silica, alumina, and pure clay by 0, and that of any impure clay by the number which denotes the per-centage of fusion-causing impurity it contains. Thus, the fusibility of a clay containing 84 per cent of silica and alumina, will be 16; and that of one which contains 90 per cent of these ingredients will be 10.

Represented in this way, the fusibility of the several tile-clays described in the preceeding section will be expressed by the following numbers:—

Cuttle-hill	...	16	Portobello	...	13½
Sherburn-hill	...	16	Forfarshire, 1. Top	...	17½
Tullarone	...	14	Forfarshire, 1. Bottom	...	20½
Argaty	...	22	2.	...	15½
The Burn—1.	...	14½	3.	...	12
2.	...	10	4.	...	14¼
Strathallan	...	18	Berwickshire—1.	...	13
Kilkerran—1.	...	17	2.	...	19
2.	...	16	Pure fire-clay	...	0
3,	...	10	Difficultly fusible glass	...	21
4.	...	13			
5.	...	20			

Such numbers exhibit very clearly the relative fusible tendency of clays, which usually contain only a very little alkaline matter. It would be unsafe, however, to apply such a scale to our artificial varieties of glass, which contain much potash and soda, as the same per centage of either of these two substances will have a greater tendency to fusion than the same quantity of either lime, magnesia, or oxide of iron.

b When the fusibility is too great, it may be diminished by an admixture of silicious sand, provided the clay is plastic enough to admit of such a mixture. It will rarely happen, that a clay which is too fusible, will not admit of such admixture, without injury to its economic value.

c Where advantage is likely to be derived from an increase of fusibility, the clay may either be washed, so as to free it from

a portion of its silicious sand, or it may be mixed with a proportion of a fatter clay, or a small per-centage of chalk may be added to it as it passes through the pug-mill. The latter will not much increase the tenacity of the clay, but it will cause its particles to cohere more readily in the fire.

§ 7. *How to make a rough examination of a tile-clay, as to its chemical properties and composition.*

a It may be washed by thoroughly mixing with water, allowing the heavy particles to subside a little, and pouring off the fine floating clay. In this way it will be easy to determine what proportion of visible sand it contains, whether it is silicious, calcareous, micaceous, &c., or whether it is coarse or fine. The effect of each of these varieties of sand has already been explained.

If still plastic and coherent, even a large proportion of sand, provided it is silicious, will not injure the clay.

b The clay may be tested with muriatic acid (spirit of salt). If it effervesce much, then it contains a considerable proportion of lime or magnesia, and will be proportionably fusible. It ought to be known, however, that the presence of as little as two parts of carbonate of lime will cause a visible effervescence.

c A red clay contains oxides of iron, which also impart fusibility. But the darkness of the red colour is not a test of the proportion of oxide of iron present in it. If the colour be ochrey yellow, it contains oxide of iron in combination with organic matter of vegetable origin. Such yellow clays, when heated in a close tube or other vessel, become black from the charring of the organic matter they contain.

If a plastic clay be white or grey only, containing, consequently, little oxide of iron, and if it do not effervesce in muriatic acid, it may at once be assumed, without further examination, that it will make very good tiles, or similar articles of manufacture.

d A minute fragment of the clay may be tried before the blowpipe. If it melt easily, then its behaviour in the furnace may be inferred. If it refuse to melt, or only fuse at the edges, it is not likely, when made into tiles, to run in the ordinary heat of the kiln.

e Lastly, the clay may be moulded into the form of a small brick or tile, and after slow drying, may be exposed to the heat of a common tile-kiln or to that of a well-regulated furnace. The appearance of the clay, after this burning, will give a very good indication of its economical value.

I have thus adverted to the greater number of the points, physical and chemical, which it seems of importance to touch upon in connexion with this subject. It is gratifying to be able to conclude, that, in addition to those superior clays which occur here and there in a state to be employed directly for the manufacture of tiles of all kinds, so many others exist, hitherto neglected, which are capable of being cheaply improved by screening, washing, mixing, &c.; that such improvable clays are scattered over nearly the entire surface of the island; and though of diverse chemical composition, that all these clays, whether natural or improved, are capable of being burned into a good sonorous ware by more or less careful attention.

The cheapening of tiles is at present an object of the highest national importance. Our machines for making tiles, and for screening or washing clays, will not come into general use till the persuasion is every where spread—*that there is no clay so apparently bad, which, by a skilful preparation, may not be made fit for the manufacture of tiles.* Once spread this conviction every where, and we shall not have so many districts remaining destitute of tile-works, under the impression that materials are not within reach which can be economically employed in them. Let proprietors become persuaded that good tiles *can* be economically made of an apparently indifferent material, and they will speedily resolve that they *shall* be made. Then will follow the demand for existing machines, and a stimulus to the production of still more improved ones; and thus abundance of material, and the appliances of machinery and manufacturing competition, will unite their influence in cheapening the instruments by means of which the general agricultural drainage of our island is to be effected.

DECISIONS IN THE SUPREME COURTS CONNECTED WITH RURAL ECONOMY.

FROM 10TH DECEMBER 1846 TO 6TH MARCH 1847.

(*Court of Session.*)

Servitude of Bleaching—Title of Inhabitants in a Burgh of Barony to vindicate right of Servitude.—William Foreman Home, heir of entail of the lands and barony of Eyemouth, and David Milne, judicial factor on the estate, brought an action of declarator to have it found that a certain well in the town of Eyemouth or in its immediate neighbourhood, and a small green between this well and the sea-beach, are their exclusive property, free from any servitude whatever; and they called as defenders one owner and several tenants of feus in the burgh of Eyemouth. The lands and barony of Eyemouth had been conferred by charter on Mr Home's ancestors by King James the Sixth, in 1597, and the town of Eyemouth was of the same date erected into a burgh of barony, with various privileges, and among others with a power to the inhabitants and burgesses to elect magistrates subject to the approval of the superior. The defenders had been in the habit of bleaching linen and washing clothes on the green, and of drawing water from the well, and they claimed the right of doing so on the ground that it was the immemorial practice of the feuars and inhabitants of Eyemouth. The well and green in question (which were uninclosed) were included in the superior's titles to the lands and barony. During the course of the action the only defender who was a feuar abandoned his defence; and decree in absence, in an action similar to the present, was obtained against the owners of the feus occupied by the remaining defenders as tenants. Various questions arose in the case: 1. Whether the law of Scotland acknowledges such a right as a servitude of *bleaching;* 2. Whether the inhabitants of a burgh of barony can acquire such a right over the property of the superior, within the burgh, by prescriptive possession; 3. Whether inhabitants, being mere *tenants*, can vindicate such a right after decree has been obtained against their own landlords; 4. Whether a burgh of barony, such as Eyemouth, is a corporation. The Lord Ordinary (Cuninghame) reported the case to the court (1st Division.) In delivering judgment their Lordships substantially answered each of the above questions in the affirmative, and the following interlocutor was pronounced: "Sustain the right of the defenders, as inhabitants of the burgh of barony of Eyemouth, to maintain the defence of the immemorial possession of the subjects in question, and remit the cause to the Lord

Ordinary to proceed further as shall be just; reserving all questions as to expenses of process."—*Home and Milne* v. *Young or Gray, and others, 18th December*, 1846. *Jurist*, vol. xix. p. 109.

Poor-law.—Assessment of Canals for Poor's-rates.—Mr Hart Anderson, as collector of poor's-rates in the parish of St Cuthbert's, brought an action against the Edinburgh and Glasgow Union Canal Company for assessments for the support of the poor in that parish during the years 1843 and 1844, which had been laid upon them as proprietors and occupants of heritable property in the parish. It had been previously decided in an action between the same parties, that "the portion of the canal situate within the said parish is assessable;" and "that the rate must be made according to the annual value of the canal as an heritable property in its present condition."* The assessment for poor's rates in the parish of St Cuthbert's had been imposed on a uniform principle for eighty years, viz.:—The whole sum required for the poor was apportioned among the heritable subjects in the parish according to their real rent, and each sum thus apportioned was paid in equal shares by the landlord or proprietor, and the tenant or occupant of the subject. Where a landlord occupied his own property he paid the whole assessment. In the present case the Canal Company were assessed in the whole amount apportioned upon their heritable subjects within the parish; *i.e.* both as proprietors and as occupants. They objected to being charged in this double capacity, and contended that they had not exclusive possession of the canal, and that the occupancy of it was with the public.† The Lord Ordinary (Robertson) repelled the defenders' pleas, and on a reclaiming note, the Court (2d Division) pronounced the following interlocutor:—"Find that, in assessing the defenders according to the annual value of the canal as an heritable property, the pursuer is entitled to take one-half of the assessment on real rent as payable by the defenders as heritors, and one-half as payable by them as occupants, and to that extent adhere to the interlocutors of the Lord Ordinary, and decern: Find that the pursuer, in making such assessment, is bound to make a deduction, and has made a deduction, on account of the capital embarked by the defenders in their carrying trade, and that the defenders now deny that

* Anderson v. Union Canal Company, 7th March 1839. Jur. xi. 409, 1 D. 648.

† The circumstances in this case arose before the passing of the late Poor Law Act, 8 and 9 Vict. c. 83, but it was admitted in argument that the recent statute had not altered the law, so far as the decision of this case was affected.

an adequate allowance is made on that account: Find that the pursuer is bound to make a deduction, and has made a deduction, on account of tenant's profits, and that, in the assessment complained of, as now explained in the minute, the defenders do not object to the deduction on this head as inadequate: Find that in regard to the house property situate in St Cuthbert's parish, and occupied by the defenders, the pursuer is entitled to deduct the rent of the same from the general revenue or annual value of the whole canal, and to assess the same as liable in poor's-rates exclusively in the parish of St Cuthbert's; and that if the defenders are exposed to any charge on account of the same in other parishes through which the canal passes, their remedy is to be obtained by objecting, according to law, to the assessment so imposed in such other parishes. And in regard to the objection stated by the defenders to the deduction made on account of the capital embarked in the carrying trade as insufficient, and also as to their objections stated in page 3d of the answers to the minute, as to the allowance for outlay on the reservoir and feeder —before answer, remit to Mr Robert Whigham, advocate, to inquire into and report upon the sufficiency of such deductions, or on the sums which ought to be allowed, if the present deductions appear to be inadequate, with power," &c.—*Anderson* v. *Union Canal Company, 14th January* 1847, *Jurist,* vol. xix. p. 187.

Statute Labour Conversion.—Imprisonment illegal through proceedings instituted before passing of 8 *and* 9 *Vict. c.* 41.—James Imrie being liable in payment of statute labour conversion money, in the county of Perth, and not having paid a sum of 15s. due from him for the year 1844, Mr John M'Whannell, the collector, proceeding in terms of the County Local Act,* on the 5th May 1845, obtained from a Justice of Peace a warrant against Imrie of poinding and sale, and (failing sufficient distress) of imprisonment for one calendar month, unless the sum due was sooner paid. By virtue of this warrant, Imrie was imprisoned on the 8th September 1845, but was released the same day on paying the amount of conversion money and expenses. Imrie afterwards raised an action of damages against the collector, on the ground that the imprisonment was illegal. In support of this action he chiefly rested upon the 8th and 9th Vict. c. 41, (the general statute labour act,) which (s. 9.) enacts,—"That it shall be competent to recover any sum under L.100 Scots, due or leviable as aforesaid, for making or repairing any highway, bridge,

* 51 Geo. III. c. 197. s. 42.

or ferry, according to the provisions of an act passed in the 7th year of King William the 4th, and in the 1st year of Queen Victoria, entituled an Act for the more effectual recovery of Small Debts in the Sheriff Courts, and for regulating the establishment of Circuit Courts for the trial of Small Debt causes by the Sheriffs in Scotland, any thing to the contrary in any local act notwithstanding: Provided always, that nothing herein contained shall in any way alter or effect any enactment or provision in any local act relative to warrants for poinding for the purpose aforesaid, or any proceeding consequent thereon, saving and excepting that it shall not be competent, after the passing of this act, to imprison any person for non-performance of statute labour, or non-payment of the conversion thereof, or assessment in lieu of such conversion." This statute was passed on the 21st July 1845, and the question came to be, whether the section quoted above, abolishing imprisonment, had the effect of rendering the imprisonment in this case illegal, the warrant having been obtained before the passing of the general act, but execution thereof not having taken place till after that date. The jury (27th October 1846) found damages due to Imrie, subject to the opinion of the court as to the legality of the imprisonment. Subsequently the case came before the Court on the 15th and 21st January 1847, and the question as to the effect of the 8th and 9th Vict. c. 41, upon the local act, was decided by the Court (Second Division) finding that the imprisonment was illegal, and that the pursuer was entitled to have the verdict applied in his favour.—*Imrie* v. *M'Whannell, 21st January* 1847, *Jurist,* vol. xix. p. 210.

Landlord and Tenant—Lease—Evidence of Local Practice.—The farm of Broompark, in the county of Linlithgow, the property of Mr Gillon of Wallhouse, had been let to James Young, by a lease which contained the following clause:—"In the last year of this lease, the tenant, if required by the proprietor, shall not have less than twelve acres under a summer fallow, or some hoed green crop, dressed and manured as aforesaid; for which grass or herbage seeds sown in the last year, and for the cost of the tillage, and the value of the whole green crop of that year, if not consumed by the tenant, he shall be paid by the proprietor, or by the incoming tenant, according to the determination of neutral men to be mutually chosen." Young's lease expired at Martinmas 1840, and the incoming tenant, John Alexander, jun., entered to the farm at that date. On the 16th November 1840, an informal submission or agreement to refer was entered into, to decide the following points: "the state of the houses upon the

said farm of Broompark—the allowance to be given for the summer fallow—the value of the dung lying upon the courts—and, generally, all questions, matters, and claims which the parties aforesaid may have, or consider they have, against one another." This document was signed by Mr Gillon's factor, Young, the outgoing tenant, and John Alexander, sen., for his son, the incoming tenant. A regular lease between the landlord and the incoming tenant was extended and signed on the 25th and 27th of January 1841. This lease contained no allusion to the document of the 16th November 1840, nor any mention of payment to be made for the summer fallow received at the commencement of the lease; but it contained a clause, in regard to leaving summer fallow at the end of the lease, in terms very similar to that which had been in the previous lease to Young. No decision upon the points referred was given till the 9th December 1842, when the oversman pronounced an award, which made no mention of Alexander, the incoming tenant, but found the landlord liable to Young in the sum of L.30, 1s. 6d., with interest. Alexander having refused to pay the above amount, Mr Gillon, the landlord, paid it to Young, and brought an action in the Sheriff Court of Linlithgow for relief against his tenant, Alexander. A proof was allowed as to Alexander's actings under the reference, and his communings with the landlord prior to the execution of the lease, and as to the custom of the district in regard to the liability of incoming tenants to pay for summer fallow; and the Sheriff, proceeding partly upon the written documents, and partly upon the parole evidence, decided in favour of the landlord. The case being advocated to the Court of Session, the Lord Ordinary (Wood) substantially adhered to the judgment of the Sheriff; but Alexander having reclaimed, the Court (Second Division), Lord Medwyn dissenting, reversed the previous decision, and pronounced the following interlocutor:—"Find that the obligation or agreement libelled on is not contained in the contract of lease between the parties: Find that there is no written evidence sufficient to prove such obligation as a separate and independent agreement, and that any evidence of practice in the part of the country where the farm is situate is incompetent to establish the same: Therefore, sustain the defences, assoilzie the defender from the conclusions of the libel, and decern, with expenses." *—*Gillon* v. *Alexander*, *22d January* 1847, *Jurist*, vol. xix. p. 214.

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* The following are excerpts from the opinion delivered by the Lord Justice-Clerk in this case:—"Trifling as the sum here in dispute is, the case involves, in my apprehension, a question of legal importance, and of general application." "The summons sets forth a clear enough case, if it had been made out as therein

Landlord and Tenant—Submission—Effect of Death of Party. —Lawrence Sinclair was tenant of certain lands in Shetland under a tack which expired in 1823, and at the conclusion of his lease he made certain claims upon the proprietrix. Arthur Cheyne having been bound under the tack as Sinclair's cautioner, and having also, along with John Cheyne, advanced money to Sinclair during the subsistence of the lease, the following letter was addressed in September 1824, by Sinclair to the agent of the proprietrix:—"Sir,—John and Arthur Cheyne,

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stated." [Recites narrative of summons.] "There is here an express agreement libelled on, and without notice of any regular contract of lease between the parties. And the averment as to practice is introduced further as a separate ground of action, though it may be intended to be used perhaps to explain the reasons for entering into the express agreement. But this, I apprehend, to be clear, that the practice cannot be used to enlarge the terms of any agreement between the parties, or to make that mean one thing, viz., a binding and an express agreement, when the terms employed would not justify such an interpretation. So far as there is an agreement, it must be taken and construed as it stands, with reference, of course, to the subject matter of the agreement. The practice cannot be used to introduce into the agreement, by implication, an obligation which is not contained in it." "I hold that I must find proper and sufficient written evidence of the obligation undertaken by the tenant; and that such an obligation, not contained in the regular and anxious lease between the parties," (signed after the reference was acted on but long before any thing was ascertained under it) "cannot be proved by a landlord by parole evidence as to communings between the parties antecedent to the term of entry, or conversations subsequent thereto, seeing that, if such obligation was undertaken, but the time for performance not come, the lease was the proper document to contain the same. Whether, if a special obligation towards the outgoing tenant shall be made the subject of a separate and immediate covenant in a special document at the term of entry, leaving no doubt that it was to hold good in favour of the outgoing tenant, whatever was in the lease between the landlord and incoming tenant, the same would be sufficient to decide questions of relief between the two latter, not in the regular contract of lease, subsequently executed to settle all questions, I shall not say—because all would depend upon the terms of such a special document. But of this I have no doubt, that if any obligation can be founded upon by the landlord, as here, against the tenant, giving him claims out of alleged agreements and covenants antecedent to, and not noticed in the regular contract of lease—such obligation must, at least, be in writing, and must be wholly, completely, and fully proved by writing. In that event parole evidence may be competent to show that such a written obligation was acted upon, as a matter separately concluded and fixed, and in order to show that there was no necessity for that agreement being in the subsequent lease, for the parties took the matter to be separately settled. But parole evidence to prove such an obligation, by conversations, the recollection of alleged promises, by the supposed admissions of one man acting for another,—*or* parole evidence to give a meaning to a separate and antecedent writing, which that writing will not itself bear in legal construction; and so, by aid of the parole evidence, to import into this antecedent writing an obligation which, even by implication, cannot be obtained out of it, and for which the writing gives no other support than room for conjecture as to motives,—in either of such cases, parole evidence I hold to be clearly incompetent as a means of rearing up against a tenant a distinct money obligation, said to be undertaken at the commencement of his lease, and

Esquires, my cautioners in the late tack of Northroe, &c., having the sole right to the tenant's debts, and all other claims I have on the family of Westsandwick, I hereby request you will consider the same as their property, and direct it to be paid over to them accordingly." Some years after, Arthur and John Cheyne constituted their debt against Sinclair by decree in the Sheriff court of Shetland, and used arrestments thereon in the

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which is not included in the contract of lease signed within three months of the entry." "I am brought, then, to very important and fundamental principles in the law of contract, and in that branch of the law peculiarly applicable to the contract of lease:—1. That communings, conversations, or loose, and imperfect, and indirect writings, the terms of which alone do not prove a distinct and separate contract or covenant, cannot be referred to after a regular contract of lease has been entered into, in order to fix on the tenant other and separate money obligations not contained or referred to in that regular and completed contract, in whatever manner such antecedent communings and alleged agreements are proved. 2. That parole evidence is wholly incompetent in support of such a claim, when used to prove the alleged object, and understanding, and effect of any antecedent writing, in itself insufficent, and to give to such writing a meaning which its terms do not warrant in legal construction, and also to shew that it was moreover intended to stand by itself as a separate covenant, and so not intended to enter into the lease subsequently executed between the parties. There is no safety in departing from these principles. Specious and plausible specialties may be found in almost every case, especially if the tenant enters before the regular lease is adjusted; and if such a case as the present shall be held to warrant a departure from these principles, a wide door will be open for litigation on matters which these rules are intended to exclude, and which the adjustment of a regular deed ought to exclude." "The practice of the country, or rather of that county, or portions of it, is founded upon as a separate ground of liability in one view or another, as part of the proof in support of the alleged object of parties in entering into the reference. If taken as a separate ground of liability, in order to establish against the tenant at the commencement of the lease, a money obligation not in the contract of lease, it is wholly untenable in law; for the decisions—holding that the practice of the country cannot be legitimately founded on to rear up obligations against the tenant as to matters at the close of the lease, whether regulated by the lease directly or not, are *a fortiori* of much greater weight when the attempt is made to prove a separate money obligation, to be fulfilled at the commencement of the lease. and which, therefore, ought to have been under the immediate view of parties when the contract was entered into, if it formed any part of their agreement; but of which prestation, nevertheless, no notice is taken in the lease itself. If the practice of this part of the country is used as part of the proof, to make out what effect ought to be given to the reference, and in combination with the parole evidence on other points, then it is incompetent, *first*, on the ground that it is used in order to give a meaning and effect to a document in itself insufficient to prove any such obligation, and which contains no reference to that alleged practice; *secondly*, on the ground that this is the use of parole evidence to rear up an obligation not in the regular contract of parties; and, *thirdly*, because on all matters on which there may be common and local practice, such evidence would be equally competent as to every part of the term of tenancy, and as to every branch of the relations of landlord and tenant after a regular contract has been entered into, in order to exclude all such disputes."

hands of the proprietrix. In 1836 a submission was entered into between the proprietrix, Mrs Ogilvie Robertson, (with the consent of her husband) and Sinclair, the late tenant, (with consent of John and Arthur Cheyne, arresters of certain balances alleged by Sinclair to be due to him by Mrs Ogilvie Robertson,) of all claims arising out of Sinclair's tack. Before any award was given under this submission, Sinclair himself, Mrs Ogilvie Robertson's husband, and John Cheyne, died. Henry Cheyne, as representing John Cheyne, proposed to sist himself as a party to the submission; Mrs Ogilvie Robertson declined acceding to this, and maintained that the submission had expired by the death of the parties. The arbiter held that the submission was still subsisting; and ultimately proceeded, in the absence of Mrs Ogilvie Robertson, to decide the case, and pronounced a decreet-arbitral, finding certain sums of money to be due by Mrs Ogilvie Robertson to Arthur and Henry Cheyne, as in right of Sinclair. Mrs Ogilvie Robertson then raised an action in the Court of Session to reduce and set aside the decreet. The Court (First Division,) adhering to the Lord Ordinary (Wood's) interlocutor, found the decree void and null on the grounds maintained by Mrs Ogilvie Robertson.—*Robertson* v. *Cheynes*, 27*th January* 1847, *Jurist*, vol. xix. p. 224.

Landlord and Tenant—Desertion of a Farm—Action of Removing.—John F. Home of Wedderburn, Esq., let the farm of Cairnhill in Berwickshire, to Thomas Cossar, for nineteen years from Martinmas 1833. Cossar went to America in 1844, and it was alleged by the landlord that he was bankrupt, and had left the country to evade his creditors; but this allegation was denied on behalf of the tenant, and it was averred that the tenant intended to return, and had appointed his brother manager of his farm. In December 1845, the landlord obtained sequestration of the crop and stocking on the farm in security, and for payment of the rent. In March 1846, on the landlord's petition, the Sheriff appointed a judicial manager of the farm. In June 1846, the landlord also raised an action against the tenant in the Sheriff Court, for removing and for caution, under the provisions of the Act of Sederunt 14th December 1756,*

* "Where a tenant shall run in arrear of one full year's rent, or shall desert his possession, and leave it unlaboured at the usual time of labouring, in these, or either of these cases, it shall be lawful to the heritor, or other setter of the lands, to bring his action against the tenant before the Judge Ordinary, who is hereby empowered and required to decern and ordain the tenant to find caution for the arrears, and for payment of the rent for the five crops following, or during the currency of the tack, if the tack is of shorter endurance than five years,

averring that Cossar was in arrear of rent to the extent of L.160 (L.340 being the yearly rent of the farm); and that, having become bankrupt, he had left the country, and that the farm was abandoned, and not properly laboured. Defences were lodged for the tenant; but they did not verify any thing to exclude the action, and no caution was lodged. The Sheriff thereupon ordered the tenant to find caution for the arrears and next five years' rent, before allowing the action to proceed. Caution was not found, and the Sheriff in consequence pronounced decree of removing. Against this decree, a note of suspension was presented on the part of the tenant, and claiming to have the note passed without caution or consignation. The case was argued upon the terms of the Act of Sederunt of 1756,* and the Sheriff Court Act of Sederunt of 1839;† and the Court (First Division,) adhering to the Lord Ordinary (Fullerton's) interlocutor, refused the note with expenses.—*Cossar* v. *Home*, *28th January* 1847, *Jurist*, vol. xix. p. 228.

Salmon Fishings—Landlord and Tenant—Reserved Right of Angling.—Sir James Miles Riddell, being proprietor of one half of the fishings on the river Shiel, in the county of Argyle, and Mr M'Donald of Lochshiel being proprietor of the other half, the latter gentleman let his half of the said fishings, on a lease, to Sir J. M. Riddell's commissioners, in order that they might be in a position to let the whole together to a tacksman. In this lease, the "right and privilege of angling, or rod-fishing," was reserved to "both proprietors, or gentlemen having their permission and authority," under a stipulation, that "all the

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within a certain time to be limited by the judge; and failing thereof, to decern the tenant summarily to remove, and to eject him in the same manner as if the tack were determined, and the tenant had been legally warned in terms of the Act 155."—*Act of Sederunt, 14th December* 1756, § 5.

* "Upon passing any bill of advocation, or suspension of a decreet, or process of removing, or at least within ten days after the date of the deliverance thereon, the complainer shall be obliged to find sufficient caution, not only for implement of what shall be decerned on the advocation or suspension upon discussing thereof, but also for damage and expense, in case the same shall be found due. And upon the complainer's failing to find caution as aforesaid, such bill of advocation or suspension shall be held to be refused; and it shall be lawful for the other party to proceed in his action of removing, or in the execution of his decree, as if no such bill of advocation or suspension had been presented or passed."—*Act of Sederunt, 14th December* 1756, § 6. See also preceding note.

† "In actions of removing, and in summary applications for ejection, the defender shall come prepared with a cautioner for violent profits at giving in his defences or answers, unless he instantly verify a defence excluding the action."—*Act of Sederunt, 10th July* 1839, § 4.

salmon or grilse caught by either party" was "to be delivered up, and belong to" the tacksman of the fishings. In March 1843, Sir J. M. Riddell's commissioners, for a stipulated rent of "L.450, and 400 lbs. weight of kain salmon and grilses, to be delivered annually," let to James Blackwood Gemmill, on a nineteen years' lease, "all and whole the salmon fishings in the river Shiel," and certain other streams, &c., with power "to fish and take with cobles, nets, and other engines, all the salmon, grilses, sea-trout, or eels, that can be caught within the bounds aforesaid;" but reserving to "Sir J. M. Riddell, and to his heirs and successors, and to the proprietor of the lands of Lochshiel, and to those having their authority," "the right of angling with the rod" in the streams, &c., let; declaring, however, that this right was "not to extend to the angling of par, smoult, or salmon fry;" and that "all the salmon-grilse and sea-trout caught by such parties," should belong, and be delivered, to Gemmill the tacksman. In March 1844, Sir J. M. Riddell's commissioners delegated to Dr M'Donald this reserved right of angling on the Ardnamurchan side of the Shiel, together with a certain right of shooting, for three years, at a rent of L.60, but still reserving a right of angling to "Sir J. M. Riddell and his son, with their friends." This delegated right of angling was sublet by Dr M'Donald to Mr Henry Esdaile, together with a certain right of shooting, at a rent of L.160. Mr Esdaile's lease declared that the fish were "to be taken and belong to" Gemmill "the tacksman," excepting 200 lbs. weight of salmon and grilse (being one half of the kain fish,) "to be used by Mr Esdaile." Mr Esdaile accordingly exercised the right of angling; but Mr Gemmill, the tacksman, applied for a suspension and interdict against Sir J. M. Riddell's commissioners, on the ground that the reservation in his lease did not authorise them to let the reserved right of angling for rent, and that Mr Esdaile had destroyed a great number of fish, which he carried off, and had not accounted for. On the part of Sir J. M. Riddell's commissioners, it was denied that they had improperly exercised their reserved right, and it was stated that Mr Esdaile was willing to account for all the fish taken, and to pay for any excess over the 200 lbs. of kain fish. The Court (First Division) refused to grant the interdict [illegible] as regarded the carrying away the fis[illegible] Riddell's commissioners, or those [illegible] they held could not be set against [illegible] the tacksman insisted on it, be [illegible] Gemmill [illegible] Riddell 16th February 1847.

Parochial Schoolmaster.—Right of Access to Proof led before a Presbytery.—Samuel Ferguson, parochial schoolmaster at Kirkpatrick Durham, in the presbytery of Dumfries, was charged by Adam Skirving and others with various acts of cruel and unjustifiable severity in the chastisement of his scholars. The presbytery (to whom belonged jurisdiction in the matter) found the libel relevant, and admitted the charges to proof. When the proof for the prosecution had been closed, and a portion of the exculpatory evidence led, Ferguson presented a petition to the presbytery, craving in general terms access to the proof (which was said to extend to seven or eight hundred pages,) and other documents and records, in order that he might furnish his counsel with a copy. The presbytery refused the prayer of this petition, and Ferguson thereupon presented a note of suspension and interdict to the Court of Session against their proceedings. In the meantime Ferguson presented another petition to the presbytery, in more precise terms than the former one, expressly limiting his demand to access to the proof in the hands of the presbytery clerk, and declaring that he neither sought to borrow up the proof, nor to see any of the presbytery records other than those specially connected with his own case. The prayer of this petition was granted. When the suspension and interdict came to be discussed in the Inner-House, the Court (First Division) were of opinion that the presbytery had not acted legally in refusing the first petition. Although its prayer might have been in terms too extensive, they were bound to have given to Ferguson that reasonable access to which he was entitled.* In consequence of the deliverance of the presbytery upon Ferguson's second petition, and of a minute lodged on their behalf in the Court of Session, the application for interdict became unnecessary; but the presbytery were found liable in expenses.—*Ferguson* v. *Skirving and others*, 17*th February* 1847, *Jurist*, vol. xix. p. 298.

Master and Servant—Desertion of Service—Violation of Agreement by Reduction of Wages.—George Coatsworth entered into written articles of agreement with the Dumbarton Glass Company in November 1838, whereby he, on the one part, bound himself to work as a servant for seven years, and they, on the other hand, became bound to pay him wages at the rate of L.1, 10s. per week, and also to give him two rooms and coals, or an allowance of L.8 yearly in lieu thereof. It was further declared by the articles of agreement, that if the Dumbarton Glass Co.

* At common law, and under the statute 1686, c. 18.

should discontinue their works, they should have it in their power to put an end to their contract with Coatsworth, on giving him one month's warning, or on payment of one month's wages. In 1843 Coatsworth's wages were reduced to L.1, 5s., and his yearly allowance to L.5. He continued in the employment of the Company, however, receiving this diminished rate of wages, till May 1845, when, after giving a fortnight's notice, he left it, and entered service elsewhere. In July 1845 the Dumbarton Glass Company presented a complaint to the Sheriff of Dumbarton against Coatsworth as for desertion, founding upon the written articles of agreement of 1838, and craving the sheriff to grant warrant for Coatsworth's apprehension and imprisonment, until he found caution to complete the full term of seven years, for which he had agreed to serve. Coatsworth was accordingly apprehended, and rested his defence upon the reduction of wages mentioned above, as having taken place in 1843, which he contended was a breach of the written agreement on the part of his employers, and left him an ordinary servant, at liberty to terminate his service when he pleased. The sheriff then granted a warrant to liberate him on his finding caution to appear at the diets of court, and a record was made up. The Dumbarton Glass Company admitted the reduction of wages, but averred that it was agreed to by Coatsworth, as, owing to the depression of trade at the time, they must otherwise have put an end to the contract, by dismissing him altogether, and that the original written articles were still a subsisting agreement in every respect, except as to the rate of wages. This was denied by Coatsworth, and the Dumbarton Glass Company were unable to offer written proof of its truth. The sheriff, holding that the original written agreement had been terminated by the departure from it as to wages, and that Coatsworth's service from that date must be attributed to a new agreement, which was only verbal, and therefore could not subsist for longer than a year, and which, moreover, was not the agreement which was made the subject of the present complaint, assoilzied Coatsworth with expenses. The Dumbarton Glass Company advocated the case to the Court of Session, where the sheriff's judgment was affirmed by the Court (First Division) upon the same grounds, and with additional expenses. —*Dumbarton Glass Comvany* v. *Coatsworth*, 18*th February* 1847, *Jurist*, vol. xix. p. 316.

Poor Law—Settlement of a Married Woman deserted by her Husband.—William Fraser resided for more than three years, commencing in 1823, in the parish of St Nicholas, Aberdeen, earning his livelihood as a tailor, and during this period he married. He then enlisted in a regiment at Gibraltar, but obtained his

discharge in 1830, after having been nearly four years in the army. In the latter part of that year he returned to Scotland, and lived, with his wife and children, at St Andrews, a burden upon their resources, till 1831, when he deserted them, and went to New South Wales. Of his subsequent history nothing certain was known, but it was stated that he lived in adultery with another woman as his wife, and that he died in 1839 or 1843 in a poor's asylum at Sydney. Mrs Fraser, after her husband's desertion in 1831, removed from St Andrew's, first to Aberdeen and then to the parish of St Cuthbert's, Edinburgh, where she remained four years as a housekeeper in a lady's family. In November 1838 she left this situation and went to Helensburgh, where she acted as a teacher for nine months, and then became insane. After being in an asylum at Greenock, and subsequently in the Crichton Institution at Dumfries, she was confined, by judicial authority, in March 1845, as a pauper lunatic in the Royal Lunatic Asylum at Morningside, near Edinburgh, at the expense of St Cuthbert's parish. The question then arose, whether Mrs Fraser's industrial residence in St Cuthbert's parish for more than three years after her husband's desertion, gave her a claim against that parish for support, or whether, being a married woman (although deserted,) she was incapacitated from acquiring a settlement by residence herself; and if so, whether she had a claim for support from the parish of St Nicholas, that being the parish where her husband (so far as was known) had last acquired a settlement in Scotland, and it not being known that he had afterwards acquired a settlement elsewhere. Accordingly the inspector of the poor for St Cuthbert's brought an action against the inspector for St Nicholas, to have this settled, and to obtain relief from the latter parish.*

The Court (First Division) were equally divided upon the point, the Lord Justice-General and Lord Mackenzie being in favour of the liability of St Nicholas' parish, and Lords Fullerton and Jeffrey being of opinion that St Cuthbert's was liable. The whole judges of the Court were then consulted, and by a majority (9 to 4) the following interlocutor was pronounced, —" Find and declare that the Parochial Board of the said parish of St Nicholas, Aberdeen, and James Fowlie, inspector of the poor thereof, are liable for the support of the said Ann Anderson or Fraser; as also in payment to the pursuer, as inspector of the

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* The recent statute (8 and 9 Vict. c. 83) did not affect this case, the 76th clause enacting, that nothing herein contained " shall be held to affect those persons who, previous to the passing of this act, shall have acquired a settlement by virtue of a residence of three years, and shall have become proper objects of parochial relief."

poor of St Cuthbert's parish, of such sum as said parish has disbursed for and on account of her support, with interest from the dates of disbursement till paid: but in respect of the whole circumstances of the case, find no expenses due to either party." —*Gray* v. *Fowlie*, *5th March* 1847, *Jurist*, vol. xix. p. 363.

Poor-Law—Arrears of Aliment—Advocation from a deliverance of Heritors and Kirk-Session, without the intervention of the Board of Supervision.—Isabella Gunn, residing in the parish of St Cuthbert's, Edinburgh, having been delivered of a natural child in January 1844, obtained a Sheriff Court decree against the father for in-lying expenses and aliment. Without using diligence thereon, she, in February 1845, being unable to support the child, offered an assignation of the decree to the heritors and kirk-session of the parish, and claimed from them payment of the said in-lying expenses and aliment. In March 1845, the kirk-session gave the following reply to this application:—"The meeting having considered the whole circumstances of this case, leave it optional for the said Isabella Gunn either to keep the child herself, and continue to receive her present out-door allowance, or to surrender the child, to be nursed at the expense of the parish, the managers reserving right to claim, and, if necessary, sue for such amount of her income hereafter as it may be found she can reasonably afford to contribute towards the expense of the child's support. *Quoad ultra*, refuse the desire of her petition." The out-door allowance alluded to as having been hitherto given for the child was 4s. per month. The Poor-Law Amendment Act (8 and 9 Vict. c. 83) was passed in August 1845, and in December following, Isabella Gunn presented a complaint to the Board of Supervision in terms of the statute,* and prayed the Board, if upon inquiry it should be found that her complaint was well founded,

* The 74th Clause of the statute enacts, "That in every case in which any poor person shall consider the relief granted to him to be inadequate, such poor person shall lodge, or cause to be lodged, a complaint with the Board of Supervision, which Board shall, and is hereby required, without delay, to investigate the nature and grounds of the complaint; and if, upon inquiry, it shall appear that the grounds of such complaint are well founded, and if the same shall not be removed, then the said Board shall, by a minute, declare that, in the opinion of the Board, such poor person has a just cause of action against the parish or combination from which he claims relief; and a copy of such minute, certified and signified by the secretary, shall, if required, be delivered to such poor person and upon the production or exhibition of such minute or certified copy thereof such poor person shall forthwith, and without any further proceedings, be entitled to the benefit of the poor's roll in the Court of Session; and it shall be lawful for the Board of Supervision, after any action has actually been commenced by or on behalf of such poor person, to award to him such interim aliment as to the said Board shall seem just during the dependency of such action, which award the Parochial Board of every such parish or combination shall be bound to obey." And Clause 75 enacts, "That it shall not be compe-

to grant the certificate necessary to enable her to obtain the benefit of the poor's roll in the Court of Session. In reply to this application the secretary of the Board wrote to Isabella Gunn's agent—"I am directed to acquaint you that the Board cannot receive the petition, as it is not in the form prescribed by the rules of the Board, and that the Board declines to interfere in respect of claims existing prior to the statute 8 and 9 Vict. c. 83." In June 1846, Isabella Gunn brought an advocation from the deliverance of the heritors and kirk-session in the Court of Session, in defence to which it was pleaded that the action was incompetent, in absence of the statutory certificate from the Board of Supervision. The Lord Ordinary (Cuninghame) was disposed to think this plea well founded, but being of opinion that the Board of Supervision had acted erroneously in refusing to entertain the complaint, his Lordship pronounced an interlocutor allowing Gunn to apply again to the Board of Supervision, and recommending the Board to re-consider her application. In the meanwhile the inspector of the poor for St Cuthbert's parish intimated to Gunn that the parish was ready to receive both her and the child into the poor-house, and that if she did not choose to avail herself of this, the out-door allowance would be discontinued; and this being stated to the Lord Ordinary, his Lordship pronounced another interlocutor, recommending Gunn to make a new application to the Parochial Board, under three heads, viz.—1. For arrears—2. Against removal to the poor's-house—and 3. For future aliment; and to bring their reply, if unsatisfactory, under the review of the Board of Supervision. Accordingly Gunn applied to the inspector of the poor for a printed form, in order to make a new application to the Parochial Board; but she was informed that the case having been already disposed of, no new application could be received. She then presented a renewed application to the Board of Supervision under the three heads specified by the Lord Ordinary, and received an answer substantially the same as before in regard to the claim for arrears, and certifying that she had no ground of complaint in regard to the second or third heads of her claim. Thereupon the Lord Ordinary reported the case to the Court (First Division,) by whom the following interlocutor was pronounced:—"In respect that the present advocation is brought from a deliverance of the heritors and kirk-session, which does not require the interposition of the Board of Supervision, Find the same competent, and remit to the Lord Ordinary to proceed accordingly: Find the advocator entitled to the expenses

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tent for any court of law to entertain or decide any action relative to the amount of relief granted by Parochial Boards, unless the Board of Supervision shall previously have declared that there is a just cause of action, as herein before provided."

occasioned by the discussion on the question of competency, &c."—*Gunn* v. *Heritors and Kirk Session of St Cuthbert's, March 6,* 1847, *Jurist*, vol. xxi. p. 390.

(House of Lords.)

Heir and Executor.—Division of Rents under 4 and 5 Will. IV. c. 22.—The Brucklay estates, in the counties of Aberdeen and Kincardine, were entailed upon a series of heirs; one of whom, the late John Duff Dingwall, after being for some time the heir in possession, died on the 26th of October 1840 without issue. Arthur Dingwall Fordyce, the next heir of entail, thereupon succeeded to the entailed estates; but Mr Duff Dingwall left a settlement constituting Sir Henry Bridges his sole executor, and conveying to him his unentailed property. Mr Dingwall Fordyce, the heir of entail, uplifted the rents of the entailed estate for the half-year ending Martinmas 1840, and payable at that term; while Sir H. Bridges, the executor, drew the rents which had fallen due at the previous term of Whitsunday, and had not been paid to Mr Duff Dingwall, the previous heir in possession. This was done without objection at the time, and it was according to the practice hitherto recognised as in conformity with the respective legal rights of heirs and executors in Scotland. Sir H. Bridges, the executor, afterwards preferred a claim against Mr Dingwall Fordyce, the heir, for a proportion of the rents, for the half-year current at the death of Mr Duff Dingwall, the previous heir in possession, corresponding to the period between the preceding term of Whitsunday, and the 26th of October, the day of Mr Duff Dingwall's death; although these rents were not due or payable by the tenants till the term of Martinmas next following. This claim was rested upon a statute passed in 1834, (4 and 5 Will. IV. c. 22,) which it was alleged had altered the law of Scotland in regard to the division of rents between heir and executor, and to enforce his claim, Sir H. Bridges brought an action against Mr Dingwall Fordyce in 1842. The parties agreed to take the opinion of the Court, in the first place, as to whether statute 4 and 5 Will. IV. c. 22, applied to Scotland at all in such a case as the present; reserving for future decision the extent to which its application could be claimed by Sir H. Bridges in the particular circumstances in which he stood towards the heir and the estate. The whole judges of the Court were consulted, and the majority of them found that the statute extended to Scotland.* The point was then carried by appeal to the House of Lords, and there the judgment of the Court of Session was unanimously affirmed.—*Dingwall Fordyce* v. *Sir Henry Bridges, 23d February* 1847, *Jurist*, vol. xix. p. 322.

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* 7th March 1844, *Jurist*, vol. xvi. p. 428. 6 D. 968.

Deed of Entail.—Power to sell Entailed Lands, on condition of entailing others instead of those sold—Sir David Baird, Bart., heir in possession of the entailed estates of Newbyth and Gilmerton, brought an action to have it declared that the fetters of his entail did not effectually prohibit him from selling the entailed property. The grounds in support of the action were of a technical nature, and depended upon the legal construction of the various clauses of the deed of entail. The deed of entail reserved to the heir in possession power to sell any part of the entailed estate, with the exception of the manor-places, provided that he previously purchased lands of the same value, and secured them to the heirs according to the destination of the entail; and the chief question came to be, whether this clause was so worded as to compel the heir in possession, so selling the entailed lands and purchasing others, to execute an entail of the lands purchased, similar to the entail over the lands sold. The parties who defended the deed of entail were Walter James Little Gilmour, Esq., to whom Sir David had made a conditional sale of a portion of the entailed lands, and the next heirs of entail. The Court of Session (the whole judges,*) found that the deed of entail effectually prohibited a sale, unless the condition of substituting other lands was strictly complied with; and, upon appeal, the House of Lords affirmed this judgment.—*Sir David Baird, Bart.*, v. *Little Gilmour and Others, 25th February* 1847, *Jurist*, vol. xix. p. 339.

THE FARMER'S NOTE-BOOK.—No. XVI.

Richardson on the Domestic Fowl. †—This little work is a cheap and compendious summary of nearly all most deserving to be known respecting our domestic poultry, by one who seems to have considerable practical acquaintance with the subject. We believe that the general management of poultry has been a good deal improved of late; but much may yet be done, especially in improving the breed, and selecting the most useful varieties. Among the peasantry and small farmers, a very poor and degenerate race of fowls is generally found, and these occasion just as much trouble and expense in keeping as a more valuable race. Were they made sensible of this, and facilities afforded for introducing an improved breed, which can be so easily multiplied, no inconsiderable benefit would accrue to them. Much good has arisen, in regard to the improvement of the breeds, by

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* 10th February 1844, *Jurist*, vol. xvi. 291. p. 6 D. 643.

† *Domestic Fowl: their Natural History, Breeding, Rearing, and General Management.* By H. D. Richardson. Dublin, 1846.

the interest which has been lately felt on the subject by many of high rank and fortune; while, among all classes, keen poultry fanciers are to be met with.

The author shows, that besides being an interesting recreation, the breeding and rearing of poultry may be rendered a very *profitable* pursuit. Considerable profits may arise from the disposal of superfluous stock, especially if the attention be confined, as it ought, to the more valuable varieties. The selling price of Spanish and Malay fowls is about 30s. a pair, or, if sold separately, L.1 for the cock, and 15s. for the hen. Inferior specimens will not, however, produce more than one half of that sum; and this price, commonly, can only be obtained by the regular retailer of poultry. The sale of eggs is, however, in most cases, the principal source of profit. The Spanish fowls are perhaps the best layers, and their eggs will fetch wholesale, from 6s. to 9s. per dozen; by retail from 10s. to 12s. The author recommended very strongly to his countrymen, the Irish, the expediency of rearing a greater number of poultry, and especially of improving the breed by an intermixture of Malay, Spanish, and Dorking fowls. It is well known that the number of eggs received in this country from Ireland, is very great.

The following are a few statistical facts on this subject—

The number of boxes shipped by the City of Dublin Steam-Packet Company for London, during the year 1844-5, was 8,874; about the same number was shipped by the British and Irish Company, making a total of 17,148. Each box contains 13,000 eggs, but occasionally large boxes are used, containing more than four times that number. This gives the result of 23,072,400 eggs, as annually shipped for London. To Liverpool were shipped 5,135 boxes, containing 25,567,500 eggs, making a total of the shipments from Dublin alone, during the past year, to the two ports London and Liverpool, of 48,639,900, the value of which, at the average rate of 5s. 6d. for every 124 eggs, (the return made,) gives a sum amounting to about L.122,000, as the annual value of the eggs shipped from Dublin alone. The other ports ship their own eggs, and, assuming the export of Dublin to be equal to one-fourth of the exports of all Ireland, a calculation reaching much above the mark, we have very close on L.500,000, or half a million sterling, as the value of this branch of commerce to Ireland; showing also an increase of four-fold since 1835. He adds, That he has ascertained, from the same returns, that the export of eggs is now nearly doubled, namely, bordering on a million sterling.

No fewer than twenty-three varieties of the domestic fowl are described, and a few of them figured in this little work. At the head of these stands the Malay fowl, which has been extolled as the *ne plus ultra* of excellence in the poultry yard, but in the author's opinion this is scarcely justified by experience. A variety of it, however, imparts a vast improvement to our ordinary breeds by crossing, and would do so in an extraordinary degree in Mr Richardson's opinion with the Dorking.

One of the most remarkable kinds of fowl existing in this country, and of which we have often wished to see a detailed

description, with a view to determining what species it belongs to, is here named the Ostrich, or Cochin-China fowl.

This gigantic bird (says Mr Richardson) has only very recently been introduced into Great Britain, and it is to that royal patroness of poultry-fanciers, the nature-loving Victoria, that we owe their addition to our stock of domestic fowls. I do not think that as yet these birds are to be met with beyond the precincts of the royal domain at Home Park; but I trust, that erelong we shall more extensively benefit by their valuable discovery.

Since the above was written, our beloved Queen was graciously pleased to send a brace of these noble fowl to the Royal Dublin Society's Show; and Mr Nolan has also imported several specimens. Her Majesty subsequently presented her fowl to our viceroy, Lord Heytesbury. I had the honour of being engaged to describe these magnificent birds in the columns of the *Farmers' Gazette*.

This variety of fowl so far surpasses both in size and power all that we have ever yet seen in the shape of poultry, as to lead many who have been permitted to inspect them, to refer them to the family of bustards. They are, however, genuine poultry. Their general colour is a rich, glossy, brown deep bay; on the breast is a marking of a blackish colour, and of the shape of a horse-shoe; the comb is of a medium size, serrated, but not deeply so, and the wattles are double. Besides their gigantic size, however, these fowl possess other distinctive characteristics, among which I may enumerate the following; the disposition of the feathers on the back of the cock's neck is reversed, these being turned upwards; the wing is jointed, so that the posterior half can at pleasure be doubled up, and brought forward between the anterior half and the body. I am not aware whether trial has as yet been made of the flesh; but from the white colour and delicate appearance of the skin, I feel confident that they would afford a luxurious and princely dish. The eggs laid by the hen of this variety are said to be large, of a chocolate colour, and to possess a very delicate flavour. One of the hens, 'Bessy,' exhibited by her Majesty, laid 94 eggs in 103 days. What a noble cross might be produced between this prodigious variety, and the plump, short-bodied, and useful Dorking.—p. 33.

After describing the different varieties, (several of them, no doubt, constituting distinct species,) we have an account of several of the best constructed poultry houses in this country, among which stand pre-eminent that in the Home Park at Windsor, and Lord Penrhyn's at Winnington in Cheshire. The various kinds of geese and ducks are also treated of; many suggestions made for improving their condition, along with a description of the diseases to which all domestic poultry are liable, and the best methods of cure.

*Leslie and Bartlett on Indian Corn.**—All seem to be agreed as to the useful properties of Indian corn as a cheap and nutritious food both for man and cattle, and also as to the power of America to supply it to any amount likely to be required. In

* *The Indian Meal Book;* comprising the best American receipts for the various preparations of that excellent article. By Eliza Leslie of Philadelphia. London, 1846.

Maize, or Indian Corn; its advantages as a cheap and nutritious article of food. By John S. Bartlett, M.D. London, 1846.

the prospect of it being much used in this country to supply the want occasioned by the lamentable failure of the potato crop, we have had various treatises on the best methods of preparing it for the table, among which the two named at the bottom of the preceding page are among the cheapest and most useful.

It is well known that the rearing of Indian corn has been attempted in this country, and we believe that in a few instances, where the locality and the season have been peculiarly favourable, the earliest varieties have ripened. But the dampness of the climate, the deficiency of sunshine, and the general heaviness and coldness of the soils in this country, make it impossible, in the opinion of an eminent agriculturist, who is well acquainted with the cultivation of this plant in America, to cultivate it on a large scale as an article for human consumption. This must be admitted, we think, by every one who is acquainted with the nature of the plant. "But I am not certain," says the author alluded to, "that it may not succeed as a green crop for fodder. If so, it would be found that no crop would yield more, or more nutritious food for stock; or make more milk, beef, or mutton; or furnish a better feed for horses. It is confidently stated, upon authority which I cannot doubt, that it has yielded in New England, at the rate of thirty-nine tons of green food to an acre; and some persons have assumed that double this quantity can be grown. A distinguished agricultural friend here, (*i. e.* in England,) is now making the experiment of growing it for green food. We must wait for the result." * Even though not used here for more important purposes, it might, if duty free, be imported with advantage for fattening swine and cattle, and feeding horses.

In the countries favourable for its growth, it is among the most valuable products of the earth; and there is perhaps no other crop whatever that can be raised at so little expense, and yields so much per acre, both for man and beast.

Upon it, (in the United States,) says Dr Bartlett, children thrive, and adults labour, without the assistance of wheat. It is prepared in an infinite variety of ways—in cakes, in puddings, in the form of bread, &c. &c., and possesses a superiority to barley in powers of sustenance, in flavour, and in expansibility during the process of cooking. It can be sold at the port of shipment at half a dollar per bushel, and, if admitted into England duty free, it could be ground into meal or flour at a cost of 6¼ cents more, making in all 75 cents or three quarters of a dollar. Allowing, in addition to this, 25 cents for retail profits, the article could be sold at one dollar a bushel in the manufacturing towns, or about four shillings and fourpence sterling. Now the bushel weighs at least fifty-eight pounds, which, at four and fourpence, is less than one penny sterling per pound; and, as there would be a gain to the shipper of the difference of exchange, there can be no hazard in saying that the article would always be on sale at that price. The cheapest mode of using it is in the form of hasty

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* Colman's *European Agriculture*, p. 325.

pudding or *mush*, and in this manner, when properly cooked, its advantages as a cheap food are surprising. To establish this fact, I made the following experiment:—I carefully weighed out one pound of the meal, and gave it to a person who understood the mode of cooking it. In the course of boiling it absorbed *five pints* of water, which was added at intervals until the process was complete. The bulk was again weighed, and gave as a result *four pounds and a half*. Such are the powers of expansion possessed by this kind of grain. On dividing the mass into portions, it was found to fill *four* soup plates of the ordinary size, and, with the addition of a little milk and sugar, gave a plentiful breakfast to four servants and children.—p. 8.

We believe that most people are not fond of Indian corn flour on a first trial; but this is soon overcome, and, by a little perseverance, it generally comes to be much liked. It is best, perhaps, to begin with a mixture of it and wheaten flour; the latter, with an addition of one-third Indian corn meal, is decidedly improved by it, and obtains the preference at the tables of almost all American families. It acquires by this addition a sweetness in flavour, and a freshness that we in vain look for in bread made entirely of wheat.

Miss Leslie having lived in England, and thereby become acquainted with our national tastes, has endeavoured to make her directions clear to the comprehension of English cooks. She has likewise described the utensils used in America for preparing Indian meal, which, if considered indispensable, can either be made here or imported from the United States. She describes, very distinctly, an immense variety of different ways of preparing this substance for food; and we must refer to the work itself, not only for making bread in different ways, but also for plain Johnny cake, Indian flappers, Indian slap-jacks, egg-pone, hominy, samp, saccatash, and many other things, extremely good, we have no doubt, in themselves, but which would make a somewhat cacophenous addition to our gastronomic vocabulary.

It may be added that Indian corn is an exceedingly good food for poultry of all kinds, for rearing young calves, and for fattening hogs and cattle. It is said to impart a richness of flavour to the flesh of these animals, which no other kind of food has been found to give.

*Colman's European Agriculture.**—The results of a careful examination into the agriculture of this country, by an intelligent foreigner who has made husbandry his particular study, can scarcely fail to be of interest, while they are likely, at the same time, to be not without utility. Practices in themselves awkward and injudicious, may fail to strike us as being of that character

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* *European Agriculture and Rural Economy.* From Personal Observation. By Henry Colman. Vol. I. Boston, 1846.

from having been so long familiar to us; but to a foreigner they will immediately appear in their true light. When endeavours are made, in different parts of the world, to accomplish objects similar in their nature, it can scarcely be otherwise than that they will be attempted in many different ways, and with very different degrees of success. However superior, therefore, as a whole, any one country may be in its agricultural operation, it may frequently derive useful hints and suggestions from the practice of others, which do not admit of comparison with it in general excellence. Comparative views are often in this way highly useful, even when made between countries, which, at first sight, may seem to have little in common.

Mr Colman, who states that he has had familiar experience for half a century with the details of practical husbandry, and is well acquainted with the agriculture of the United States, was induced to undertake an agricultural tour in Europe, at the suggestion of many of his American friends, who were desirous of obtaining accurate information regarding the present state of agriculture in the old world. He reached England in April 1843; saw a portion of that country and of Scotland; and the handsome volume now before us, is made up of the results of his observations, in the shape of diverse reports. The subject of his enquiry is sufficiently comprehensive, comprising every thing connected with the cultivation of the earth, the production of food for man and beast, and the condition of those to whom agriculture is a business and a profession. He promises to limit his reports to ten. The present volume contains five, and he has visited only a portion of England and Scotland. When the remaining parts of these countries, and Ireland, are discussed, but little space will be left for the Continent. Indeed, the work might more appropriately be named "British Agriculture." Although somewhat diffuse and excursive, Mr Colman has produced a very readable book; and one which, upon the whole, will convey to his countrymen a very accurate idea of the present state of agriculture in this country. With his republican prejudices, he perhaps takes a view of certain parts of the subject in which all will not be ready to concur; but it ought to be recollected that our own bias is in an opposite direction, and, unless guarded against, may likewise interfere with our perception of the truth. To one who has a preference, as he himself expresses it, for institutions founded on the great principles of universal liberty as the birthright of every man, and of social equality as conformable to nature, the condition of our labouring agricultural population is a subject of lamentation.

The condition of the labouring agricultural class is certainly, in many parts of England, exceedingly depressed; and though in frequent instances it may be called comfortable, in few that I have seen can it be considered prosperous. Their labour is not extraordinarily severe; they are by no means treated with

unkindness, or, excepting through the misfortune of the ill-temper of their employer, with severity; they are decently clad, and there is a great amount of active benevolence every where at work to assist them, and to alleviate their distress in sickness and misfortune. But they are very poorly fed; with many exceptions, they are wretchedly lodged; their wages are inadequate to their comfortable support—and their situation affords little or no hope of improvement —at least, the power of making it better does not rest where it should, with themselves.

It is a painful, though not an unheard-of anomaly, that, in the midst of the greatest abundance of human food, immense numbers of those by whose labour this food is produced, are actually suffering and perishing from hunger; that where ten millions of acres of improvable land, capable of being made productive land, lie uncultivated, millions of hands which might subdue, enrich, and beautify this waste, from necessity remain unemployed; and that in a country where the accumulations of wealth surpass the vision of oriental splendour and magnificence, there exist, on the other hand, such contrasts of want, destitution, privation, and misery, as would surpass belief, and defy the power of the imagination, but for the support of incontrovertible and overwhelming evidence. Under the present institutions of the country, a perfect remedy is hopeless, and an alleviation of these evils is all that can be looked for. . . . . To my mind it is obvious, that no great improvement can take place in the character and condition of the labouring population, while they remain a distinct and servile class, without any power of rising above their condition. At present the most imaginative and sanguine see no probability of rising above their condition, of being any thing but labourers, of belonging to any other than a servile and dependent class. The low state of their wages absolutely forbids the accumulation of any property. They cannot own any of the soil which they cultivate. The houses which they occupy belong not to themselves, and they may at any time be turned out of them. They must ask leave to live, or they must take it by violence or plunder, when they will not be suffered to live. Their only home is the grave, and even their repose here is not always secure.—p. 63.

An American, without any hesitation, regards these evils as growing directly out of a constitution of society establishing different ranks, the accumulation of land in the hands of a comparatively small number of individuals, and its consequent high price, the depressing sense of independence, and the helplessness of competing with those who are born to affluence and distinction. As one of the best means of improving the condition of the labourer, the author advocates the allotment system, which he has witnessed in operation with the utmost advantage.

The effect of these allotments upon the character of the occupant is quite remarkable. He becomes himself, for the time being, an owner of the soil; he has a feeling of independence which nothing else can give, and which at once exalts his character. He is able to avail himself to advantage of the labour of his wife and children, who in some cases perform most of the work on the ground, in hours which would otherwise be wasted or misappropriated. His ground yields him a large supply of vegetables for his family, and enables him to keep and fatten a pig or two, and likewise some poultry, which very much conduce to his comfort and that of his family. The cultivation of the ground likewise occupies hours which might otherwise be spent in the drinking-house, where nothing good is to be learnt, and where the foundation of the ruin of many a labourer is laid; and the ruin of his family follows, generally, as matter of course. Besides these advantages from the allotment system, his youngest children are here early trained to habits of industry and carefulness. Too much indeed cannot be said in favour of the allotment system, of its justice, its humanity, and its usefulness.—p. 75.

We cannot attempt to follow our author through the multifarious topics which he discusses—sometimes with rather too much prolixity—but can safely recommend his work as containing much useful information, and affording a store of interesting reading. We may give a concluding extract in his lighter vein, referring to a somewhat singular feature in the great fair of Rosemount, county of Galway, Ireland.

There was another circumstance, perfectly unique in its character, to which I shall be pardoned for alluding. There was another species of live stock exhibited at the fair which I cannot say is never seen at such places, but which does not always present itself under the same frank circumstances. The kind nobleman who accompanied me, and who like many others, noble and simple, whom it has been my good fortune to meet with on this side the water, left no effort unessayed for my gratification. After looking at the various objects of the fair, asked me, at last, "If I would like to see the girls." I confess that my natural diffidence at once took the alarm; and my imagination cast a few furtive glances over the sea, at some precious objects I had left behind. However, upon a voyage of curiosity, why should I not see what was to be seen? and, confident that my good friend could have no sinister design, I gave him an affirmative reply. Upon inquiring of one of the trustees, or masters of the fair, "If the girls had come," we were informed that they would be there at twelve o'clock. At twelve o'clock we went, as directed, to a part of the ground higher than the rest of the field, where we found from sixty to a hundred young women, well dressed, with good looks and good manners, and presenting a spectacle quite worth any civil man's looking at, and in which, I can assure my readers, there was nothing to offend any civil or modest man's feelings. These were the marriageable girls of the county, who had come to show themselves, on the occasion, to the young men and others who wanted wives; and this was the plain and simple custom of the fair. I am free to say that I saw in the custom no very great impropriety. It certainly did not imply that, though they were to be had, any body might have them. It was not a Circassian slave market, where the richest purchaser could make his selection. They were in no sense of the term on sale; nor did they abandon their own right of choice; but that which is done constantly in more refined society, under various covers and pretences—at theatres, balls, and public exhibitions, I will say nothing about churches—was done by these humble and unpretending people in this straightforward manner. Between the noble duchess, who presents a long train of daughters, rustling in silk and glittering with diamonds, at the Queen's drawing-room—or the ladies of rank and fashion, who appear at public places with all the beauty and splendour of dress and ornament which wealth, and taste, and art, and skill, can supply, meaning nothing else, but "Admire me!"—and these honest Galway nymphs, with their fair complexions and their bright eyes, with their white-frilled caps and their red cloaks and petticoats—for this is the picturesque costume of that part of the country—all willing to endow some good man with the richest of all the gifts of heaven, a good and faithful wife, I can see no essential difference.

"Let not ambition mock their useful toil,
Their homely joys, and destiny obscure."—p. 302.

Skilling's Agriculture; and *Antisell's Manual of Agricultural Chemistry as applicable to the Soils of Ireland.**—Both these little

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* *The Science and Practice of Agriculture.* By Thomas Skilling, "Agriculturist to the Board of Education," &c. Dublin, 1846.

A Manual of Agricultural Chemistry, with its application to the Soils of Ireland. By Thomas Antisell, "Member of the Royal College of Surgeons," &c. Dublin, 1845.

works will be found well calculated to promote the purpose they have in view, which with the former is chiefly, and with the latter exclusively, the agricultural improvement of Ireland. Mr Skilling is superintendent of the national model farm at Glasnevin, and is not only well acquainted with general agriculture, but more especially with its present condition in Ireland. In the present instance he confines himself chiefly to the practical departments of the subject, for the instruction and benefit of the farming classes generally, and also with a view of adapting his work for the use of schools, where its introduction may be thought desirable. Many of his observations, on the state of farming in Ireland, appear to us of very great importance, and especially deserving of notice at the present time. He enumerates nearly a dozen of what he regards as fundamental errors in Irish farm management, which he illustrates at some length, and points out the methods by which they may be remedied:—*1st*, Suffering numerous, useless, and crooked gripes and ditches to encumber and occupy the land; *2d*, Not sufficiently draining and drying the land; *3d*, Not trenching and deepening the land; *4th*, Exhausting the land by a succession of grain or other crops; *5th*, Not following out a regular rotation of crops; *6th*, Not cultivating green crops; *7th*, Not keeping a sufficient number of cattle; *8th*, Keeping too many horses, particularly on small farms; *9th*, Not collecting and applying a sufficiency of manure; *10th*, Suffering the land to be overrun with weeds; *11th*, Ignorance, indolence, and other bad habits.

With our Irish farmer, he says, procrastination is his great enemy; he has always some difficulty to contend with, or insurmountable obstacle in his way—these obstacles and difficulties, in a majority of cases, his own creation. He is rack-rented; he wants capital; his land is poor; the seasons unpropitious; his crops fail; the government is hostile to his interests: he blames every body and every thing *but himself*, and his grievances are magnified and trumpeted forth on all occasions; but it is our duty to pause, and, if possible, determine where the blame rests, and whether these complaints are well founded. *His land is highly rented;* yet he will take more of the same quality, and at the same price, if he can get it; and he will injure or persecute a neighbour should he offer to take a portion of his trouble off his hands. *He wants capital;* yet he will not put into requisition the parents of all capital, his hands and his soil. *His land is poor;* yet he will not take the proper means of swelling his dung-heap—increase the quantity and house-feed of his cattle. *The seasons are adverse and his crops fail;* yet he will not take the proper steps to counteract bad seasons—drain and deepen his land. *He calls for, and waits for new laws;* like the waggoner in the fable, he lies in the slough and calls upon Jupiter. Thus, then, it will be found that all this formidable list of grievances—these crying evils, with a host of auxiliaries which we have not mentioned, arise from two simple causes—the man's own *ignorance*, (if we were permitted to alter the author's language, we would say, in most cases, *wilful ignorance*,) and *indolence*. —p. 46.

These truthful and forcible statements, doubtless, touch on one of the grand causes of Irish suffering and destitution—*those*

who will not work, being subjected to the natural and equitable penalty, a penalty further sanctioned by apostolical authority—*neither should they eat.* Would that we could affirm that our own countrymen, now suffering partly from similar causes, were altogether free from a similar imputation! The agricultural improvement of Ireland must always, to a certain extent, involve questions of civil polity, and be connected with other considerations than the mere practical application of agricultural knowledge to the management of the soil; but the neglect of the latter nothing can make amends for, and nothing can excuse; and there is certainly no nation, in the present day, which, in this respect, so completely incurs the emphatic condemnation which must ever be directed against those who *know to do good, and do it not.*

Mr Antisell's treatise, as far as concerns the exposition of general principles, cannot be expected to display much originality; but it is neatly and accurately written, in a style level to the comprehension of all who are likely to seek for information on such subjects from books. In the chapter which treats of the soils of Ireland there is a good deal of interesting information, and many original analyses of soils from the different geological districts of the country. From some of these analyses he derives important inferences:—

> Thus, if any one compare the analyses here given with those of England and Scotland, he will at once perceive the caution he should display in adopting any suggestions for the amelioration of his ground, founded on such opposite data; and there are peculiarities of climate and soil connected with this country which require to be studied before implicit faith be bestowed on recommendations derived from a consideration of the climate and soil of England and Scotland. For if we inquire about the limestone districts of England, we find that they bear a poor and scanty herbage, and hardly pay the trouble of being well worked; compare that with the limestone soil of Ireland, which, whether regarded as to its extent or capabilities, deserves the designation of *the soil* of this island, which, instead of being barren, shallow, and mostly elevated, is chiefly a level plain, of immense depth in many places, and of an enormous fertility.
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> Again, when we contrast the greater humidity of this island, and the much greater yearly fall of rain, we must be struck with the opinion, that manures must bear a very different value, considered as a supplement to soils. It is a known fact that guano in Ireland does not produce that amazing increase which it is known to do in Great Britain; so that the person calculating on deriving from its use a benefit equal to that obtained in the sister island, will suffer a disappointment.—p. 12.

*Guy on the Health of Towns.**—It is not a little remarkable that a matter of such weighty national importance as the sanatory condition of our large towns should have been so long in attract-

* *On the Health of Towns, as Influenced by Defective Cleansing and Drainage. And on the Application of the Refuse of Towns to Agricultural Purposes. Being a Lecture delivered at the Russell Institution, May 5th,* 1846. By William A. Guy, M.B., Cantab. London, 1846.

ing general attention; and it is much to be regretted that greater improvements have not been effected, since their necessity was shown to be so urgent. The first movement of any importance may be said to date no further back than 1842, when a report was published by the Poor-Law Commissioners on the sanatory condition of the labouring population of Great Britain. Another report appeared two years after, by a Commission for inquiring into the health of large towns and populous districts, which was followed by the publication of a vast mass of evidence, and suggestions founded upon that evidence. The subject was then taken up by the legislature, and several bills introduced to facilitate the object in view. In aid of these exertions associations were formed in the metropolis and some of the principal provincial towns, for the purpose of diffusing information on the sub ject, and procuring the means for carrying remedial measures into effect. Many individuals—among others, Lord Ebrington—have laboured, by means of public lectures, to rouse the public mind to the importance of the subject, and the pamphlet mentioned at the bottom of the page is intended to aid the same great cause. We have not seen the merits of the case more prominently brought out, and more emphatically enforced, than in Mr Guy's lecture, where statements are so concisely and perspicuously expressed, and supported by evidence of such a conclusive kind, that they come upon us with all the force of demonstration. The propositions which it is his object to establish are the three following:—1st, That towns are unhealthy. 2d, That one of the leading causes of their unhealthiness is defective cleansing and drainage. 3d, That the refuse of towns, which, when allowed to accumulate within their precincts, impairs the health of their inhabitants, and gives rise to severe and fatal diseases, m:y be most advantageously applied to agricultural purposes. The principal statistical facts by which these positions are proved cannot be too generally known or too deeply impressed on the mind; and a brief recapitulation—what alone can be attempted here—will, we hope, be acceptable to our readers.

If we compare one million of the inhabitants of large towns with the same number of the inhabitants of rural districts, the inhabitants of towns lose nearly 8000 more every year than the inhabitants of the country. The exact number is 7·773. The average duration of human life in town is much lower than in the country. The mean duration of life in Surrey is 45 years; it is 37 in London, and only 26 in Liverpool. The inhabitants of the metropolis, therefore, taking one with another, when compared with those of Surrey, lose 8 years of their lives, and the inhabitants of Liverpool 19 years! The mortality of our large towns varies from 35 in the 1000, that of unhappy Liverpool—

to 20 in the 1000, that of several populous towns. If we ask, are all parts of our large towns equally unhealthy? we may derive a negative answer from the reports of the Registrar-General, in one of which the several districts of the metropolis are divided into three groups, of ten districts each, under the titles of the *healthiest*, the *medium*, and the *unhealthiest* districts. The first of these, with an allowance of 202 square yards of space for each person, have a mortality of 1 in 49; the second, with about half that space, lose 1 in 41; the third, with the meagre allowance of 32 square yards to each inhabitant, have a mortality of 1 in 36. In further corroboration of this, it may be stated, that Liverpool, which is the most densely peopled town in England, is also the unhealthiest, and that Manchester, which emulates it in this respect, comes next in order; while Birmingham, which allows its inhabitants more room to breathe, presents a far more favourable rate of mortality. In a single metropolitan parish—that of St Giles's and St George's, Bloomsbury—while the gentry, who inhabit the open squares and broad streets, live on an average 40 years, the working class, who inhabit narrow lanes, blind courts, and dark cellars, live only 17 years; that is to say, they lose, one with another, just 23 years of their lives. In Shoreditch the loss amounts to 28 years.

In treating of his second proposition, Mr Guy states, in regard to the town of Preston, that in streets which are well cleansed and drained the mortality among children under one year old is 15 in the 100; in streets moderately cleansed and drained, 21 in the 100; and in streets badly cleansed and drained, 44 in the 100; being, as nearly as possible, three times the mortality of streets kept in proper condition. It is affirmed on the best authority, that in 20 streets in Chorlton-on-Medlock the mortality fell from 110 to 89 per annum after the streets were properly paved and drained. In certain streets in St George's, Manchester, the deaths in 1838-9 amounted to 495; but in 1841-2, after the streets were paved and sewered, the deaths were only 432, being a diminution of about one-eighth. Similar instances might be cited almost to any amount. The diseases which prevail in these neglected places are of the class of contagious disorders, Pestilence has always haunted scenes of filth. "The plague, the black-death, the camp, jail, and ship fevers, the cholera—all have made these scenes their favourite resort; and typhus fever, our modern pestilence, forms no exception to the rule."—(p. 16.) "The districts in which fever prevails," says Dr Southwood Smith, "are as familiar to the physicians of the fever hospital as their own names." What is the character of these districts? "There is uniformly bad sewerage, a bad supply of water, a bad supply of scavengers, and a constant accumulation of filth. If you

race down the fever districts on a map, and then compare that map with the map of the Commissioners of Sewers, you will find, that wherever the latter have not been, there fever is prevalent, and, on the contrary, wherever they have been, there fever is comparatively absent." The annual deaths from typhus fever amount to 16,000, and those who are attacked by this disease to between 150,000 to 200,000! Can any facts be stronger or more convincing than these?

The inducements to correct this lamentable state of things are twofold: First, the removal or mitigation of contagious diseases, which, by finding a stronghold in such places as have just been alluded to, endanger the health of an entire people; and, secondly, the valuable purposes to which the substances causing these diseases can be applied in agriculture. The fruitful cause of disease may thus be made a source of fertility—we may thus minister to the health of our towns and the fruitfulness of the surrounding country by one and the same means. It is too well known to require any further elucidation, that the refuse matters of towns are rich in the elements of production in what may be called the raw material of food. It has also been demonstrated by Mr Smith of Deanston and others, that this refuse matter can be easily and cheaply collected, distributed, and applied to the land. Much of it can be conveyed as common water, and be transmitted to great distances by means of machinery, at a rate not exceeding 2½d. a ton, in cases where the cartage would amount to 4s. While distribution in the solid form would cost about L.3, the expense in the liquid form would not exceed 6s. "I should be grieved, indeed, to think," says our author, "that this dream of sanatory and agricultural improvement was doomed not to meet with its fulfilment. I trust that either the public spirit of the government, or the commercial enterprise of the people, will soon put the value of the liquid refuse of our towns, and the proposed methods of conveying and distributing it, to the test of experiment, that we may no longer be outraged by this twofold sacrifice of human life, and of the elements of abundance."—p. 27.

This is one of those cases in which there is not so much difficulty in convincing the judgment, as in inducing people to act according to its dictates. In order to accomplish these improvements effectively, operations require to be projected on a large scale, and all great bodies are difficult to put in motion; yet the prospect of a speedy amelioration in the condition of the poor classes, combined with an almost immediate return of profit, in a merely commercial point of view, are double advantages which few enterprises can hold out. We trust that the subject will not be lost sight of, either by the legislature or by the community at large; and we are pleased to see such a publication as Mr Guy's,

which, even though it may not bring forward any new facts, yet turns to the best account such as are already known, and forms a useful remembrancer, even to those who may already be familiar with the subject.

*Abattoirs.**—The recent evidence given by Mr Smith of Deanston, before a Committee of the House of Commons, relative to "railways, and their effects on agriculture," has introduced into notice another subject, connected with the popular discussions on abattoirs. We are rejoiced to find, that that weighty engine, public opinion, is at length brought to bear upon the disgraceful old remnant of our barbaric ancestors—Smithfield, with all its horrors. Influential names are appended to a prospectus for the abolition of Smithfield as a cattle market, and for the erection of markets and abattoirs in the suburbs of London. So far good, for all circumstances connected with due cleanliness in our city are of vital importance; and thus not only will the slaughter of animals be effected at a distance from its inhabitants, but, as a consequence, their reeking hides will no longer clog the footways in Leadenhall and other markets.

Still, the plan, if adopted, would be but temporary; Smithfield itself was selected as the most appropriate spot for the purpose to which it has so long been applied; it was once a large field outside the walls. The wants, cupidity, and enterprise of man, have created buildings which closely encompass this space, and brought it into the heart of London. Thus, with cemeteries, it has been wisely ordered that they be situated in the precincts of the metropolis; but of what avail are inefficient laws? An act should be provided, and enforced, by which no house could be built within a given distance, say a quarter of a mile, from the spot intended for interment. In consequence of the want of this needful prohibition, a populous neighbourhood has sprung up almost simultaneously with the formation of and abutting on the cemetery.

So soon as these projected markets and abattoirs, in the suburbs, shall be commenced, they also will be surrounded by habitations for the convenience of persons employed in the works; and in no great length of time, every gigantic slaughter-house will become a similar nuisance to that of Smithfield and its accessory Newgate market; for men and beasts will, according to the proposed plan, necessarily congregate in the new situation, as they now do in the old spot.

We recur to Mr Smith's observations before the House. That

* We have been requested to state, that this, and the following article, on a sanatory method of sepulture, came to our hands in the early part of March last. —EDITOR.

gentleman was interrogated respecting the "advantage of transporting the carcasses of animals, as compared with the old system." His reply was—"Without a railroad it is impossible to transport fat cattle any greater distance than from 50 to 70 miles, without great deterioration; but railroads will afford the means of transporting cattle 300 or 400 miles, with great advantage; and in carcasses, they may be transported 700 miles; and in that way, may be brought from the most distant parts to populous districts, at a very small additional expense, which, with the expense of transporting either beef or mutton in the carcass, does not amount to one-third of a penny for five hundred miles; so that you may have meat nearly as cheap in London, as you have it in Inverness."

Much more, equally luminious and satisfactory, follows; but for our immediate purpose the foregoing will suffice. We have to suggest, that immense advantages would accrue to London and the country, if the introduction of *live* cattle, sheep, pigs, and poultry, were to be altogether prohibited; or at all events, placed under close restrictions. Our reasons are manifold.

1. The contemplated buildings for the purposes of slaughtering animals, and disposing of the offal, could be erected for one fourth of the expense.

2. No rural neighbourhood whatever need be desecrated by the "sounds and sights unholy" which must inevitably attend the contention of drovers, with the victims of their brutality, when collected in large numbers.

3. The expense of reconveying into the country those portions of the beasts, which, in large towns, constitute a nuisance; but are invaluable to the agriculturist.

4. That an extensive abattoir cannot be conducted with that attention to cleanliness, which one on a small scale, in a village, might and *will be*, now that commissioners are to be appointed for the surveillance of rural districts. By the facility of conveyance which railways afford, every small farmer, butcher, poulterer, and pig-killer who may choose to avoid the middleman, and trade on his own account, could supply his salesmen in London with prime joints; reserving the inferior parts (all of which, under the present, as well as the projected system, *must* be sent to the capital); so that cheap meat, in the country, such as the poor would purchase, and which is now too scarce, they could then obtain in sufficient quantities.

5. The village butcher has continual opportunities to adapt the refuse of his stock to the purposes of manure, if he be an occupier of land; and if he be not, may have instant communication with farmers in his neighbourhood, to whose fields, or mixens, the offal could be conveyed before it became offensive.

6. A shamble, whether in the metropolis or in mere hamlets,

being the nucleus round which various trades collect, would, if confined to the latter localities, tend to draw away from the overwhelming, still increasing magnitude of London, those trades which depend on the slaughterer: thus tanners, hide-factors, gluemakers, bone-digesters, tripe-manufacturers, parchment-makers, —even cats'-meat vendors, with their filthy piles of garbage, must not be omitted—these, and many other noisome avocations (which swell the objectionable bulk of foul matter, now in constant fermentation in the midst of our dense population), would of necessity be drained away innocuously into the country; where, from the very smallness of these nuisances, and their distance from one another, no possible injury could accrue to the health of the community.

We are quite prepared to meet with many objectors to these sanatory suggestions: every man whose interest would be jeopardised will be violent in deprecating them; but these persons are the dust in the balance; they constitute that small number, who *must* suffer when any public benefit is to be achieved. It, unfortunately, is always thus, in all those great undertakings which cause innovations; and we ought not to flinch fom the performance of a duty which is to ensure the health and well-being of the million because we may put to temporary inconvenience a few individuals, and cause to them the loss of a few pounds.

In all sincerity of purpose, the foregoing suggestions are offered for consideration in quarters where benefit may arise from the discussion of their validity; and though the advantages contemplated may never be realised to their full extent, a modification will assuredly be effected, and our end be so far attained.

It should be remembered, that our suggestions are borne out most satisfactorily, not only by Mr Smith's evidence,—quoted above, which states, "that *carcasses* can be conveyed 700 miles without deterioration;" but also by late complaints of extensive injury done to the living animals during their transit by railways. If, then ,we find such cogent reasons advanced against the present plans of transporting live animals to the London market, and would prevent the cruelties of metropolitan slaughter-houses, what other plan remains than that which we have suggested?

The necessity for a rational and sanatory method of Sepulture.—

To be knaved out of our graves, to have our skulls made drinking cups, and our bones turned into pipes, to delight and sport our enemies, are tragical abominations. ***—Sir Thomas Brown's *Hydristaphia.*

Although we have taken a quotation from the above noble writer's "Urn burial," we are not going to advocate *this* rational and sanatory system of sepulture; which, though long since gone into desuetude, is not unlikely to be again adopted; but the time for its revival is yet far distant.

A great and glorious spirit is abroad; true-hearted beings are working with mind, and strength, and soul for the benefit of their fellow creatures: old usages have been upturned, abuses rectified; the poor are cared for, and taught to elevate themselves; slavish worship of coroneted greatness (so called) is rapidly subsiding into a just appreciation of the baubles that glitter on the brow of a mere man; coward War is skulking from the earth, quelled by the contempt of sturdy opinion, by "Pity, like a naked new born babe," and by the quiet determination of Peace. Temperance, with mild persuasion, gains over the roystering ignorant bully Drunkenness, that has so long sodden the intellects of the people, proving that "gentleness is power." Children, by thousands, are being reclaimed from vagrancy; and their miserable elders, invited to the daily luxuries of cleanliness and order, as well as the nightly comforts of warmth, food, and a wholesome lodging. Sanatory laws are opening up a well-spring of hopefulness; and, by their general enactment, diseases will be banished from their lurking-places in the hovels of the ignorant and poor, to whom it will be exemplified that however unwittingly, yet certainly, they are vested with an awful power to foster and disseminate far and wide the horrors of typhus fever, and the contagion of other disorders.

We might extend the above list of innovations, ameliorations, and of other blessings, obtained by means of a spirit of kindness, and indefatigable industry—for "God helps those who help themselves;" but we must abstain. It is delightful to watch (amidst the darkness of this suffering period) the glorious dawning of a day that will be far brighter than has ever yet shone upon our beautiful world. The spirit of prophecy is strong upon us, and tempts us to prognosticate many events, all tending to the welfare of mankind; but the words *sanatory laws*, remind us of the purpose with which we commenced; and of those suggestions that have imbued our spirits: they are for the general advantage, and therefore merit attention.

Among the numerous enactments which have been put in operation, *that* for the establishment of cemeteries, at a distance from large towns, is to be highly commended. It was a wise and good law; and the innovation was so great, the wrench from old usages so startling, that perhaps any further attempt to overthrow the habits of a people might have been hazardous, but we are no longer an isolated community. Although living in our Britain—

In a great pool, a swan's nest,

we have heard other than our own "chimes at midnight," and now know "there's livers out of Britain" have "stood on the Rialto;"—but (more to our present purpose) have visited the

Catacombs of Paris, and have gazed with, *at first*, an awe-struck eye, and revolted feelings, upon the solemn, rational, sanatory places of sepulture in Genoa and the states of the Campagna di Roma.

Our readers are aware that we allude to those wide and deep sepulchres, on a gigantic scale, of which there are three hundred and sixty-five; one being devoted to each day of the year. When the coffins containing the bodies of one day's mortality are brought to the pit, every evening the stone is removed, each body lowered, and on every coffin is thrown a given quantity of quick-lime. The mouth is then closed, and not again re-opened for a whole year.

However much English feeling may quail under the idea of such a system being adopted in this country, it is a duty to combat an over sensitiveness, if it militate against the working of any plan for the general welfare.

Urn burial was once the customary method of disposing of the small residue of humanity, after the body had been consumed by fire; and how beautiful, how pure a method it was! This had once to be combated, and an innovation made in favour of our objectionable, and worse than barbarous system of interment. It was a retrograde step from that usage to this, which is so absurd and revolting to the mind, that the only wonder is how it could have been accomplished.

The alteration that we wish to advocate is a mere step, but with this difference, that it would be an onward movement, and *that* so important, so fraught with advantage to all living beings, that we feel it to be our own duty to communicate them, and *that* of the community, to listen to our earnest appeal, and, by application to the legislature, cause the adoption of catacombs for the burial of the dead.

A personal friend was, some years since, travelling through Northamptonshire, and, from antiquarian curiosity, was desirous to ascertain the site of that great battle of Naseby, where

> The summer's dust was laid with showers of blood,
> Rain'd from the wounds of slaughter'd Englishmen.

[illegible] out, our friend soon found how accu- [illegible] [illegible]ing, he with his stick turned up a sod of grass, [illegible] of soft fine black earth to his nose.—There was [illegible] blood still." Nearly two hundred years had rolled [illegible] that misery was even then reveal- [illegible] the proof he held that he was in- [illegible]field, where plague and pestilence [illegible] engendered, where crime begot *that* punishment, [illegible] upon [illegible] children unto the third and fourth [illegible]

Will the results of the famine now devastating Ireland disappear this season? no! nor for twenty years. Could food, even by a miracle, be placed now, and in perpetuity, in profusion at the command of every living being in that wretched, most wretched country, health, or rather freedom from disease and pestilence, is beyond their possible attainment! The source of future typhus "lies festering" at the very feet of the unwary passenger; a few inches of soil only hide, and barely hide, thousands of corpses that lie stricken by the pestilence; and these will rise again in foul miasma, in putrid gases, and spread desolation on future occupiers of that unfortunate land.

The method of sepulture which we employ is pre-eminently *that* which affords the greatest facility to the desecration of church-yards. Our quaint but good old favourite, Sir Thomas Brown, justly says, "To be *knaved* out of our graves, &c. is a tragical abomination." Thousands feel a shrinking terror at the thought of friends exhumed and extended upon the dissecting-table, amidst the gibes of surgical students; yet no one raises his voice against the practice, no one calls attention to the glaring impropriety of the legislature in conniving at this method of procuring subjects for the necessary purposes of dissection.* Sepulture in catacombs would remedy *every* evil.

When the breath of life has quitted its poor frame; when all that is loved and lovable in our most treasured friends is lost to our yearning hearts and longing eyes, and our sorrow and our thoughts go down with them into the darkness of the grave, who would not rather reflect that decomposition is finishing the sad work, with the utmost rapidity? Who would not prefer to know that all which was lovely to the sight, an infant as it may be —than which nothing can be more delicate, and which, while living, was "so sweet that the senses ached at it"—should pass at once from its purity to its original dust, without undergoing that more hideous and slow process of decay in our charnel-houses? In the one case, shut away from all contact with this "upper air," dissolving in comparative purity; in the other, too probably putrefying the atmosphere to be breathed by those who mourn its exit, and spreading the vapours of pestilence around its grave! Innocent it was in its little life, but what do we cause it to be in death?

On all sides, we hear that our poorer classes are in want of work: by adopting the mode of interment now advocated, we should employ many hundreds, perhaps thousands, in excavating

* The law is now such that subjects may easily be procured for the purposes of dissection without violation of the tomb.—Editor.

for the formation of catacombs; for in the neighbourhood of every town, and even village, catacombs ought to exist; they should be so deep that no hindrance should be offered to agriculture, as in the case of coal, and other mines. Bishops could as well consecrate a catacomb, as a church or a cemetery; and where this "rational and sanatory method of sepulture" should be adopted, the disgraceful scenes which have shocked the feelings, and injured the health of the community, would never again occur.

It is in vain that acts of parliament are passed, and committees formed, to carry out these admirable laws which are now in progress, while graves in churchyards, full to repletion, are continually being opened; and the soil, which is saturated with undecomposed bodies, is thrown out to the surface of the ground, causing continual renewal of disease. Drains and cesspools, too, even when bricked over, are obnoxious to the same objection. It is of no use attempting half measures; the evil is one of magnitude, and must be grappled with potentially; for every reader, with the very slenderest powers of discrimination, must have noticed, that in his own handsome dwelling, a brick, and even stuccoed wall, is too pervious to restrain the subtle and insinuating gas from entering where it is most unmeet! There are times when the *whole of London*, notwithstanding its admirable drainage, (that is, admirable when compared with that of most other cities, but still exceedingly defective,) *the whole of London*, we repeat, is, at times unbearable. The smell which arises from the drains, and pervades every room in the houses of the rich as well as the poor, is perfectly dreadful. This occurs previously to wet weather.

One of Doctor Darwin's fifty signs of rain, is, "the ditches smell;" and this is caused, as our readers are aware, by the extrication of sulphuretted hydrogen, when the atmospheric pressure is decreased. The cause of *that cause*, is beyond our limited powers of discovery: sufficient for us to know, and to be warned, that whenever this deleterious gas is liberated, the effects are disastrous to health and life. The only safe, because the only natural deposit, for all animal and vegetable substances, when in a state of decomposition and decay, is the earth; hence, the establishment of sewerage companies is a blessing for which the public cannot be too grateful. Our fields require precisely that which we have hitherto withheld from them; the refuse of towns is the riches of the country. Nature, our best teacher, never fails to dictate our duties to us; but we are too obtuse, or too apathetic, to attend with gratitude to her persuasions.

It is an incontrovertable fact that we have been beneficently endowed with a sense of smelling, in order that, by its use, we may guard ourselves from the danger of infectious disorders, just

as our powers of seeing were ordained that we may avoid the dangers of sudden contact. It has always been matter of surprise to us, that the value of the sense of smelling should be so little appreciated: it is used almost solely in its pleasurable, not in its important object—to enjoy the fragrance of a flower, not to shun the miseries of contagion. We may be perfectly certain, that whenever we are offended with a fœtid odour from drains or decomposing substances, we are warned, as by divine interference, to shun an attack on health, it may be life itself. Can we then place too high a value on this gift? Is it possible to urge too strenuously upon the legislature the onerous duty which devolves upon them, that of insuring the health and lives of the public from injury and destruction, substituting for the present objectionable method of interment, that of rational and sanatory sepulture in catacombs?

Enclosure of English Commons.—Among the numerous Acts of commission by our legislature, that for the "Enclosure of Commons and Severalties," is one that most excites our surprise: and among those of omission, that of leaving millions of acres, in various districts of this thickly populated country, in a state of utter waste, and worse than uselessness, most rouses our indignation. In the former case, land of the most beautiful description, which has been under cultivation from time immemorial; fields that have required no division, are, by Lord Lincoln's act of last session, in course of enclosure: and now that we more than ever require every inch of available soil to be brought into tillage, acres and acres, in even *one farm*, are abstracted from the occupant, for the sole and absurd purpose of digging a preposterously wide ditch, and throwing up a bank like a rampart, on which is planted a hedge to foster vermin, shelter birds, obstruct the sun, facilitate the growth and disseminate the seeds of troublesome weeds!—now, too, that our hedges are, by all intelligent farmers, acknowledged to be inimical to their interests, and that every occupier of land is levelling those which merely divide different portions of a farm!

We really are curious to know what valid reason could be given for this reckless waste of land; it cannot be because this carefully tended property has been invaded by contiguous cultivators; nor because the fields which generally border the high road have been overrun by cattle, or pillaged by trespassers: No! there they have remained open to the influence of the invigorating sun, and exposed to every depredation since long before the originator of the act was born: and not only have they never been encroached upon, nor the primitive "land marks" removed, but they have produced some of the finest and most remunerating crops imaginable; and have been freest from weeds of any in the dis-

tricts, because they have hitherto not been surrounded by those nurseries of rubbish—banks and hedgerows. The subdivision of these fields, too, has been no expense to landlord or tenant to keep in order;—yet the fiat has gone forth, and the enormous hedge-banks are in progress.

Now that railroads are ramifying all over the surface of the country, remorselessly appropriating the very marrow and fatness of the soil, and subjecting the heart of England to their iron rule; now that the additional abstraction of land, on this mighty, on this gigantic scale, is going on and still increasing; it is surely matter for deep anxiety and reprehension, that the waste land—commons, heaths, downs, and wolds—of the country should be suffered to remain in all their original barrenness: no effort is made to reclaim these, no edict issued to bring them into cultivation. What can be done to animate the government from their supine state, and induce them to adopt vigorous measures on this momentous, this most vital subject?

A population requiring eleemosynary food and prompt employment, a country depending upon foreign supplies for the nourishment of its inhabitants, is assuredly not in a condition to afford that *one* acre of its soil should lie idle: but what is the fact? That there are millions of acres, whole districts of wide dreary expanse, devoted to no one earthly purpose; over which the eye of the traveller wanders, in pained surprise, and the heart of the philanthropist mourns.

Some time since, when the subject of enclosure of commons was agitated, it was annoying to hear the mawkish, one-sided, sentimentality of the adverse party; they deprecated the measures because the poor would be deprived of those free spaces for the purpose of recreation: "It would be barbarous to confine them to the high roads," they said, "and such a deal of skimble skamble stuff," was uttered, that one's better nature was up in arms to quell the silly tumult. Would any man, who *is* a man, pretend to assert that he believes the tumbling of a few children on the grass, in the rural districts, ought to be put in competition with the food of hundreds? Heaven knows we would be the last to deprive our poorer brethren of "space and verge enough" for their athletic sports: but this superabundant population must be cared for in its sterner wants: we must advocate the *utile* rather than the *dulce*; both if possible; but if one be incompatible with the other, the *dulce* must succumb. Lovely as are the brakes and commons of erewhile "merrie Englande," beautiful and cheering as is the sight of her peasantry in groups, enjoying the health-breathing sports, we feel that the time is arrived for them to be consecrated to even a higher object than enjoyment; and we know that they ought to be devoted to the food of

man rather than the nibble of a few sheep, which their scanty herbage cannot half maintain, and the growing of bunches of furze

That bud lavish gold

for the cottager's fire, which they cannot half supply.

We could now point out tracts of rich uncultivated land, within forty miles of the metropolis of the world, as wild and pathless as they were when the turf yielded to the hoof of the highwayman's horse; and now that men have congregated, and hamlets are seated in midst of these wastes, their inhabitants wade ankle deep in mud. No road, no footpaths, no hint at a species of civilisation to which in this great, this inconsistent country, all its population ought to have attained. To one such spot, if a stranger were suddenly conveyed, he would suppose himself hundreds of miles from London. These are "Crown lands;" and they are jewels, though as yet in the rough, worthy to be so called: beautiful as the other gems of the royal diadem, and as useless, too, to the community.

We have lifted up our feeble voice, would it were trumpet-tongued, to rouse the legislature from their apathy, that they might feel the importance of the subject, and enact a law for the cultivation of waste lands; so that the present scandal to the rulers, and cruelty to our suffering poor, should cease to be a disgrace to this magnificent country.

Jones' Turnip Husbandry.—This little work is one of the many of a similar kind which the present exigencies of Irish agriculture have caused to appear from the Irish press. The author, Mr Jones, has had the good fortune first to study Scottish practical agriculture upon a Scottish farm, under one of the best class of our Scottish tenantry, and is now enjoying his second year's studies in the laboratory of the Agricultural Chemistry Association of Scotland.

In treating of the culture of the turnip, therefore, he has been enabled "to present to the reader a better view of the whole subject than either science or practice could enable an author to do." He considers, in succession, the preparation of the soil, the application of manures, the sowing of the crop, the thinning, the after-culture, and the raising of turnip seed, the storing and consumption of the crop, the folding of sheep on turnips, the feeding of milk cows and of horses.

Most of our readers are already acquainted with Mr Huxtable's successful practice with the raising of turnips on very poor land. Mr Jones gives an accurate account of the special mixtures hitherto successfully used or recommended by him and various other authorities.

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* *Turnip Husbandry, a Series of Papers on the Culture and Application of this important Root.* By David F. Jones. With a Preface by Professor Johnston Dublin: James M'Glashan. 1847.

It is only by carefully conducted experiments with special mixtures of *known* composition that results worthy of reliance are obtained, or such as can be expected again on after-trial. Mixtures sold under the name of turnip manure are not to be depended upon, as they may be made of one composition to-day and of another to-morrow. When our practical men shall know how to adapt the composition of their manures to the combined wants of their soil and their crops, agriculture will escape from the hand of empiricism, and the manuring of the soil will be cheaply, efficiently, and certainly performed.

Potatoes and Mazagan Beans. By Mr ALEX. JAMIESON, Lauder.—I take the liberty of acquainting you respecting a crop of potatoes and mazagan beans I had last year. Mr Brown, gardener to the Earl of Lauderdale, here, having often mentioned to me that he was surprised to see farmers plant mazagan beans as a crop in the fields, I last year made a trial of them in the following way, on the 2d of May, which I think had the disadvantage of being too late in the season; viz: I placed a bean every yard, with two sets of potatoes between them, in the usual manner of planting potatoes, and was very much surprised to see from one to ten stalks tiller out from each bean. I showed specimens of the crop at a horticultural show here, and the people were much astonished at them, never before having seen beans so very prolific. I planted one bushel of them in the above manner, on about two acres and a half of land. The potatoes were nearly a failure, but I had a return of 21 bushels of beans, without taking into account a large quantity destroyed by the wood-pigeons and crows.

Temperature of the Ground—Heat and Cold—By MR TOWERS.—I offer no apology for introducing a subject, in the form of quotation, which possesses the liveliest interest. True it is that many extensive readers have seen the original authority—have believed or doubted; but there are others for whom the extract I present will possess the charm, at least, of novelty. Be this at it may, I hope that the present liberty may be productive of good in some form or other.

The statement of the wonderful phenomenon which forms the basis of this communication is introduced by observing, that hitherto the results of experiments made in boring, mining, and the like operations, tend to prove "that there is a stratum throughout *the whole earth*, at the depth of from 40 to 100 feet, where the temperature *is invariable*—the same at all times and seasons, and which differs but little from the annual mean of the country above the surface." At the equator this stratum is stated to be at little more than a foot in shaded places; that in the temperate region,

as for instance about Paris—which in latitude north is little more than half of the quarter sphere extending between the line and the north pole—has never been above or below 53°, which is only 2° above the annual temperature at Paris.

If we are to place any confidence in the article now open before me, there exists in Siberia a sort of ground ice or frozen subsoil always present; of this remarkable and anomalous phenomenon the following are some of the details:—

"In the cold regions of the earth's surface, the soil, to a certain depth, is *always* frozen, whatever may be the temperature of the air and vegetable soil above or of the strata below. That this is the case to some small depth, has been long known in Siberia, but it is only lately that the great thickness of the frozen stratum has been ascertained." Gmelin, in his Travels, stated the circumstance; and persons sent about the middle of last century by the Academy of Sciences at St Petersburgh concurred in the general facts, but Von Buch, among other scientific men, threw doubt upon the accuracy of the statements. However, to proceed with the extract, it is there said that—"A few years ago a merchant at Yatutsk, of the name of Scargin, began to sink a well, but found the ground frozen so hard that he was about to give up the attempt. Admiral Von Wrangel, the celebrated traveller, advised him to proceed until he came to the bottom of the icy ground; he did so, and sent to the Academy of Sciences of St Petersburgh a report of his proceedings. He had to dig through 382 English feet before he arrived at the loose and unfrozen soil, the whole of the vast intermediate mass of earth being at a temperature below the freezing point, and almost totally uninfluenced by summer heats. The temperature was about 18° Fahrenheit, 14° under the freezing point;" or, in the language of gardeners, 14° of frost, 'at a few feet below' the surface of the ground; and gradually increased with the depth, until the freezing point was attained, at about the depth mentioned above."

We need not proceed further on this individual subject: numbers of Russian and German philosophers have anxiously sought for facts and evidences to discover the limits of the frozen soil. The Academy of Sciences at St Petersburgh, desirous of ascertaining how far the influence of the air and of summer heat may affect the frozen ground, caused a number of thermometers to be buried in the earth at the sides of the deep well sunk through the earth at Yatutsk, the place before named. The instruments were placed in pairs at the depth of 1, 3, 5, 10, 20, 50, 100, 150, 200, 250, 300, and 350, feet; one of each pair, the bulb immersed a foot in the side earth, and the other to the depth of a fathom. The results have not as yet been reported. I now refer to another article which contains matter of still more grave importance, as

it refers to the sporting of nature in the deposition of ice at a considerable depth below the surface.

The Cavern of Yeermalik is a natural curiosity that has been brought into notice by the publication of Captain Rollo Burslem's *Peep into Toorkisthan* in 1846. It is described in that part of the work which gives an account of the writer's Journey from Cabul to the Dauab. It will be useless to refer to any particulars, however interesting in themselves, which do not bear upon the subject of frozen soil; I therefore come direct to the point, after observing that the traveller had entered into the cavern, and after penetrating far into the bowels of the earth, through passages of extreme difficulty and danger, his attention was suddenly roused, on emerging from several low arches and small caves, by "a strange glare which spread itself about, and after a few more steps a magnificent spectacle presented itself. In the centre of a large cave stood an enormous mass of clear ice, smooth and polished as a mirror, and in the form of a gigantic beehive, with its dome-shaped top just touching the long icicles which depended from the jagged surface of the rock. A small aperture led to the interior of this wonderfull congelation, the walls of which were nearly two feet thick. The sides and roof were smooth and slippery, and our figures were reflected from floor to ceiling, and from side to side, in endless repetitions. The inside of this chilly abode was divided into several compartments of every fantastic shape; in some, the glittering icicles hung like curtains from the roof; in others, the vault was smooth as glass. Beautifully brilliant were the prismatic colours reflected from the varied surface of the ice when the torches flashed suddenly upon them as we passed from cave to cave. Around, above, beneath, every thing was of solid ice: and being unable to stand, on account of its slippery nature, we slid, or rather glided, mysteriously along the hall of spells. In one of the largest compartments the icicles had reached the floor, and gave the idea of pillars supporting the roof."—Can such things be?

The only analogy, if such it may be considered, is found in the mines of rock-salt: therein we have the evidence of decisive fact, the validity of which none can doubt: but here the question is of ice, a matter which cannot exist in a temperature any degree exalted. Be this as it may, authority on both phenomena is before the public; and taking their trustworthiness for granted, it remains to reflect upon their nature, and so endeavour to acquire a glimpse of their actuating cause. Philosophers have inferred that the heat of the globe increased in proportion as it was penetrated in depth; but the theory was found untenable from a variety of contending and opposed facts. That its heat should be higher, or more temperate, when beyond the reach of direct frost, or the heating power of the sun's rays, might reasonably be expected; thus at the bottom

of a deep draw-well the water may be found to indicate ten, twenty, or thirty degrees of Fahrenheit, in the *coldest* weather of the *severest* winter, above that of the open air; but what shall be said when we find springs and fountains of *boiling water* emerging from the earth, in localities where ice and snow are ever present. Is not the phenomenon itself entirely at variance with the theory of earth heated from beneath? But what is heat? We can certainly refer it to the sun's direct ray as a general principle; but one which is subject to so many modifications, that the mind obtains no satisfactory evidence of its precise nature. The late Professor Leslie, when attempting to form a theory of the internal constitution of the globe, stated it as his opinion, founded upon experiment, that the earth must be hollow and cavernous; the central cavern being of necessity filled with a substance of vast repulsive power, to which cavern the surface is as it were a mere crust or shell, bearing but a small proportion to the diameter of the sphere. There is but one substance which appears to possess the necessary elasticity; and that substance is light, in its most concentrated state, which, when embodied, constitutes elementry heat or fire. If we admit this visionary play of the imagination, and presume that the centre of the globe is replete with condensed elementary fire "shining with intense effulgence and overpowering splendour," we acquire no solid foundation capable of supporting a true theory of terrene heat or cold. Light indeed is visible in the chaste and softened diffusion which a covering of white clouds produces: it is still more evidently revealed in the direct ray of white light; and then also its heating becomes sensible, and the more strikingly so when rendered focal by a glass lens. But still we are perplexed, and know not how to reconcile apparently discordant facts. To chemistry we can, however, appeal as elucidatory of the two great facts, that both heat and cold, to a degree which would surpass conjecture, are excitable by the chemical play of affinities, and therefore we may safely refer the opposing states of situations which ought to be similar, as for instance the crust of the earth at given depths, to chemical disturbances between the elements of water and a variety of metallic or sulpho-metallic substances that are frequently combined with the proper earths.

Mrs Somerville, in the 25th section of *The Connection of the Physical Sciences*, "On the Temperature of Space," tells us that "all observations made under the surface of the ground concur in proving that there is a stratum at the depth of from 40 to 100 feet *throughout the whole earth*, where the temperature is invariable, at all times and seasons, and which differs but little from the mean annual temperature of the country above. In the course of more than half a century, at the depth of 90 feet, in the caves of the Observatory near Paris, it has never been above or below

53° of Fahrenheit's thermometer, which is only 2° above the mean annual temperature of Paris."

These are plain and sweeping assertions. They either are rigidly true, or ought not to have been hazarded. However, there can be little doubt that, at a certain distance below the surface great regularity must prevail, unless in cases where there exist local causes of disturbing chemical action, when either heat or cold will be developed: I use this participle for a definite purpose, which will be alluded to hereafter. In the mean time, to approach nearer home, we will just look at the evidence that may be deduced from observations upon the temperature of deep wells; making due allowance for the effect which may be produced by the action of atmospheric air passing down the shaft from above upon the surface of the water. I possess a well which at this moment requires 105 turns of a rack-wheel and fly ere the bucket at the top can reach the surface of the water; and about 14 turns more of chain require to be added after the drought and heat of summer. Now, as each turn raises above 15 inches of chain, the 120 turns will indicate about 150 feet depth of shaft. Chalk abounds in our district, and the water holds a rather full portion of carbonate, and some sulphate of lime, in solution; the well is coverd by flap doors, and these are not opened, upon an average, above three times in 24 hours, one bucket being always in the water, which now is at least 24 feet deep in the well. I have at this individual point of time raised a bucket, and find the temperature to be 52°; the weather has been cold and frosty at night, and we have now passed through 24 weeks of wintry weather. During actual frost the water feels quite tepid, and steams copiously. Thus, by actual trial of my well on this 22d day of April, the heat is in fair accordance with the average mean of the latitude of London.

To return to Mrs Somerville; she observes (p. 260), "Should the earth's temperature increase at the rate of 1° every 50 feet, it is clear that at the depth of 200 miles the hardest substances must be in a state of fusion, and our globe must, in that case, be a ball of liquid fire 7600 miles in diameter—for 200 miles are nothing when compared with the size of the earth. No doubt the form of the earth—as determined by the pendulum and arcs of the meridian, as well as by the motions of the moon—indicates original fluidity, and a subsequent consolidation and reduction of temperature by radiation; at all events, internal fluidity is not inconsistent with the present state of the earth's surface, since earthy matter is as bad a conductor of caloric as lava, which often retains its heat at a very little depth for years after its surface is cool. Whatever the radiation of the earth might have been in former times, certain it is that it goes on very

slowly in our days;" decreasing, according to M. Fourier, only about the 36,000th part of a second in a century. "As regards animal and vegetable life, it is of very little consequence whether the centre of our planet be liquid fire or ice, since its condition in either case could have no sensible effect on the climate of its surface. The internal fire does not even impart heat enough to melt the snow at the poles, though so much nearer to the centre than other parts of the globe."

Having thus produced all the evidence that is required to throw light upon the received theories of the earth's temperature, and to show clearly that there are facts antagonist to each other, I shall offer a few remarks upon the probable causes of several existing phenomena.

The earth is unquestionably the *recipient* or laboratory of magnetism. Magnetism is so far allied to electricity that whenever one is present, the other becomes revealed, passing at right angles as a spiral worm round the excited fluid. Thus if *an electric* current (as it is called) passes through a bar of *metal*, another *of magnetism* will coil round the bar. They then co-exist, yet evince different qualities. With these truths before us, knowing nothing of proximate causes, *yet being permitted to reason* from analogy and induction of facts, while we feel assured that the sun is the great fountain of *light*, and the great *ultimate* cause of all electro-magnetic phenomena, we may be permitted to suppose that, as *electricity* is a heat-producing agent, so magnetism, which circulates round it at right angles with the passing current, may be the original, or direct cause of *cold!* Assuming, then, that the magnetism of the earth is the principle of cold, and that it may be traced to the blue ray of the sun, and *vice versa* in respect to electricity, then we obtain, hypothetically, a key to the mystery which involves the subject of this article; namely, the supposed regularity, in temperature, of the earth at a certain depth below its surface, and the astonishing exceptions to the rule afforded by the caverns, or immense masses of ice, of which the extracts I have collected furnish surprising examples.

The late most beautiful phenomenon which adorned the heavens on the night of March 19th last, one day before the spring equinox, must not be passed over in silence. After a day of uncertain character, low and falling barometer, heavy clouds, wind south-east to south-west, the evening became clear, and small black clouds floated occasionally over the western sky. Soon after 9 o'clock P.M. a luminous beam arose in the west, or at least appeared to have its origin there; it passed over Taurus, not remote from the bright star in the Bull's eye and the planet Jupiter, thence near Gemini, and so on direct to east; but with us it never reached the eastern horizon. For a time the beam was wavy, and of irregular breadth; but at length its two sides became parallel and

regular. As every passing cloud obscured the beam, it certainly was above the region of clouds. About 10 o'clock, the horizon, due north, was illuminated with a bright, pale aurora borealis; and thus, judging by the direction of the beam, through the course of the ecliptic, the electricity so developed had induced a rectangular development of northern magnetism. I have more than once observed a beam similar to the one of March 19th, and it was always followed by a wet season, as in the year 1816; but I never recollect a similar double phenomenon. Rain did not follow in any quantity, though there were trifling showers during five days. About the last week of March, cold weather, however, predominated (very sunny and parching by day), especially about sunrise, frosty rime being visible upon grass meadows, to the first day of May.

From every fact that has been noticed we attain perhaps something like philosophic evidence that cold is a substantive agent, one that does not depend upon the mere absence of heat; and if this be so, we need go no farther in inquiry respecting the cause of an accumulation of subterrene masses of ice. Magneto-chemical agency may also be appealed to; for why should we hesitate thereon, when every modern authority admits, nay, insists upon, the heat-producing and decomposing energy of *electro-chemistry*.

The nature of the soil is capable of producing local differences of temperature, for if certain salts abound, and come in contact, a great degree of cold is immediately manifested; thus snow and salt cause an immediate development of cold; and numbers of chemical neutral salts have similar results when combined, and act as freezing mixtures upon water which is within the sphere of their influence. A very slight covering, even that of grass turf only, acts as a protector to the soil beneath it, even when the frost above is of intense severity. Thus in 1838, when about the 21st of January my thermometers marked 2° below zero, a vine-border was prepared in a portion of grass-meadow; the turf required the utmost power of a strong man with a pick-axe; but at the depth of three inches below, the spade raised the soil without difficulty. In laboured garden soil, no effort sufficed to move the clods.

But these circumstances, and many of a similar character, are of no avail in throwing light upon the secret operation of nature in producing opposite extremes of heat and cold. We can only refer, as stated above, to electro and magnetic influences as real agents, or to chemical action excited by their agency.

I have brought forward the fact, as stated, and have ventured to offer a few arguments very inadequate to explain the causes of phenomena so obscured by mystery; if these, however, may lead to further inquiries, and tend to disturb vague unphilosophic hypotheses, I shall not have written in vain.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 5th of April 1846 and 5th of April 1847—showing the Increase and Decrease on each head thereof.

	Quarters ending April 5.		Increase.	Decrease.	Years ending April 5.		Increase.	Decrease.
	1846.	1847.			1846.	1847.		
	L.	L.	L.	L.	L.	L.	L.	L.
oms	3,961,918	4,447,673	485,755	...	17,664,618	18,796,620	1,132,002	...
se	1,626,458	1,652,865	26,407	...	11,886,085	12,547,657	661,572	...
ps	1,685,868	1,817,282	131,414	...	7,095,521	7,062,828	...	32,693
s............	146,142	130,802	...	15,250	4,224,039	4,257,158	38,119	...
-Office	215,000	219,000	4,000	...	768,000	820,000	52,000	...
ellaneous .	136,522	129,593	...	6,929	318,888	430,161	91,273	...
erty Tax .	1,963,882	2,033,072	69,190	...	5,084,741	5,464,581	379,840	...
	9,735,790	10,430,287	716,766	22,179	47,041,892	49,379,005	2,354,806	32,693
	Deduct decrease on the quarter		22,179		Deduct decrease on the year...............		32,693	
	Increase on the qr. ...		694,587		Increase on the year		2,322,113	

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Markets.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
Danzig	60/ to	65/	32/ to	39/	20/6 to	26/	37/ to	42/6	40/ to	45/	42/ to	46/
...	65/	75/	34/6	40/6	24/	29/	40/	45/	44/	48/6	44/	48/
...	68/	78/	38/	45/6	26/	30/	42/	48/	45/	52/	44/	50/
...	70/	81/6	40/	52/	26/6	32/	45/	50/6	48/	56/	45/	52/
Hamburg	60/	65/	29/	39/	22/	27/	40/	44/	45/	50/	44/	48/
...	65/	78/	34/	41/6	25/	28/6	42/	50/	50/6	61/	45/	51/
...	70/	80/	38/	45/	26/	29/	45/	57/	50/	56/	46/	54/
...	76/	86/	45/	54/	27/6	32/6	42/	54/	52/	58/	45/	52/
Bremen	63/	68/6	35/	40/	24/	28/6	46/	54/	48/	54/6	42/	48/
...	68/	74/6	38/	43/	24/6	29/	48/	56/6	50/	61/	45/	52/
...	72/	78/	39/6	45/6	25/	30/6	49/	57/	50/	58/	46/	54/
...	74/	80/	42/	50/	26/	32/	48/	56/	48/	56/	46/6	55/
Konigsberg	58/	64/6	35/	40/	22/	28/	42/	50/	42/	52/	45/	54/
...	60/	66/	38/	45/	22/6	29/	44/	54/	45/	54/	46/	56/
...	63/	68/	40/	48/	24/	30/	50/	57/	50/	58/	48/	58/
...	68/	78/	44/	52/6	25/	31/6	52/	58/	52/	62/	48/	56/6

reight from the Baltic, 5/ to 8/, and from Trieste, Alexandria, &c., 8/6 to 13/6. Vessels
y scarce, some of the Baltic vessels having made two trips this season, bringing grain, wood,
, and taking back coal, &c.

PRICES OF BUTCHER-MEAT.

ONDON. tone of 14 lb.			LIVERPOOL. Per Stone of 14 lb.				NEWCASTLE. Per Stone of 14 lb.				EDINBURGH. Per Stone of 14 lb.				GLASGOW. Per Stone of 14 lb			
	Mutton.		Beef.		Mutton.		Beef.		Mutton.		Beef.		Mutton.		Beef.		Mutto	
/9	7/6 to	8/6	7/ to	7/9	7/3 to	7/9	6/6 to	7/6	6/9 to	7/9	6/6 to	7/6	6/9 to	7/6	7/ to	7/9	7/3 to	
/8	7/9	8/6	7/3	8/	7/3	8/	6/9	7/6	6/9	7/9	6/9	7/9	6/9	7/9	7/3	8/	7/6	
/6	7/3	7/9	7/	7/6	7/	7/6	6/6	7/3	6/6	7/6	6/3	7/0	6/6	7/6	7/3	7/9	7/3	
/3	7/9	8/6	7/6	8/	7/3	7/9	6/9	7/9	6/9	7/9	6/6	7/9	6/9	8/	7/6	8/3	7/6	

PRICES of English and Scotch WOOL.

English, per 14lbs.		
....	13/ to	17/6
rease, ...	9/	14/
Down,....................................	13/	18/
ed,..	10/6	15/
r Hogg, ...	12/	17/6
e and Hogg,...........................	9/	16/
....	6/	8/6
....	5/	7/

Scotch, per 14lbs.		
Leicester Hogg, ...	12/6 to	18/
Ewe and Hogg,...........................	9/	14/6
Cheviot, white,...........................	8/	12/6
Laid, washed..............................	6/	9/6
unwashed,..............................	5/	8/6
Moor, white,................................	5/	7/
Laid, washed, ...	4/	6/
unwashed,..............................	3/	5/

*The Average Price of the different kinds of GRAIN, per Imperial Quarter, so[ld in the]
following Markets:—*

LONDON.

Date.	Wheat. s. d.	Barley. s. d.	Oats. s. d.	Rye. s. d.	Pease. s. d.	Beans. s. d.
1847.						
Feb. 6.	76 4	55 1	34 8	60 6	60 6	55 9
13.	74 4	56 1	34 11	58 1	61 6	55 6
20.	73 8	57 2	33 1	56 11	60 0	54 0
27.	74 4	58 5	33 6	58 0	59 2	54 2
Mar. 6.	75 11	58 3	32 6	57 8	57 6	52 11
13.	76 5	55 11	30 3	57 1	60 7	52 8
20.	78 7	55 9	31 11	56 0	60 3	50 9
27.	78 5	53 9	37 5	55 8	59 1	51 2
Apr. 3.	79 3	55 11	31 11	57 0	60 7	49 10
10.	77 1	55 4	36 9	56 0	57 3	47 9
17.	77 2	52 6	33 2	57 0	56 8	47 2
24.	77 11	50 0	28 4	53 0	55 4	46 8
May 1.	84 4	57 3	28 11	55 10	57 9	49 3
8.	85 8	52 6	28 4	58 5	55 0	50 4
15.	89 6	55 6	30 0	58 6	55 7	52 2
22.	100 5	60 4	29 4	64 9	63 1	55 6
29.	105 2	60 3	32 5	67 8	60 2	55 9

EDINBURGH.

Date.	Wheat. s. d.	Barley. s. d.	Oats. s. d.
1847.			
Feb. 3.	64 6	49 3	36 8
10.	68 3	51 4	37 4
17.	73 4	54 6	41 6
24.	70 8	54 11	40 10
Mar. 3.	71 8	54 9	40 6
10.	66 2	63 0	39 8
17.	73 0	55 5	41 0
24.	73 4	52 9	40 7
31.	69 5	50 9	37 2
Apr. 7.	71 2	46 6	35 7
14.	72 5	46 9	37 3
21.	73 11	50 2	37 11
28.	75 0	51 3	37 7
May 5.	78 4	54 4	38 5
12.	84 0	57 1	41 3
19.	88 3	54 3	41 4
26.	81 8	53 8	41 6

LIVERPOOL.

Date.	Wheat. s. d.	Barley. s. d.	Oats. s. d.	Rye. s. d.	Pease. s. d.	Beans. s. d.
1847.						
Feb. 5.	73 2	41 1	30 3	58 6	64 3	50 10
12.	72 8	41 10	34 9	57 4	71 5	52 5
19.	76 10	40 6	37 5	56 10	69 6	54 9
26.	78 3	40 11	37 10	57 2	69 0	54 7
Mar. 5.	75 1	42 11	37 11	56 9	57 3	53 9
12.	78 2	40 5	35 9	58 6	60 6	53 9
19.	78 4	48 3	38 11	59 4	64 0	55 0
26.	76 5	49 1	37 8	59 6	60 2	52 5
Apr. 2.	78 6	50 2	37 2	59 8	54 0	53 10
9.	71 0	48 6	34 2	60 2	51 9	49 6
16.	72 3	46 4	35 10	58 4	53 6	50 6
23.	73 10	45 6	31 9	56 2	55 0	48 6
30.	76 2	40 8	36 2	55 6	57 2	48 3
May 7.	76 5	44 2	36 3	57 9	61 10	55 7
14.	83 6	48 0	37 5	58 10	56 11	55 0
21.	90 10	54 0	38 5	60 8	61 6	50 10
28.	97 0	58 8	41 1	64 9	63 6	60 4

DUBLIN.

Date.	Wheat, p. barl. 20 st. s. d.	Barley, p. barl. 16 st. s. d.	Bear, p. barl. 16 st. s. d.
1847.			
Feb. 5.	46 4	29 6	25 0
12.	47 10	30 7	26 0
19.	48 11	30 10	24 6
26.	48 0	27 9	25 4
Mar. 5.	47 11	29 6	25 9
12.	47 9	29 6	26 2
19.	48 11	30 2	27 2
26.	47 5	28 9	27 1
Apr. 1.	45 9	28 3	26 8
8.	45 6	28 0	25 4
15.	46 8	27 9	25 10
22.	48 0	28 0	26 11
29.	48 4	29 11	26 4
May 7.	47 8	28 9	26 8
14.	51 0	28 2	25 10
21.	54 0	28 0	25 6
28.	53 3	28 6	26 0

TABLE showing the Weekly Average Price of GRAIN, made up in terms of 7th a[nd 8th Geo.] IV., c. 58, and 5th Vict., c. 14, and the Aggregate Averages which regulate the [Duties pay]able on FOREIGN CORN: the duties payable thereon, from February to Jun[e]

Date.	Wheat. Weekly Average.	Wheat. Aggreg. Average.	Wheat. Duty.	Barley. Weekly Average.	Barley. Aggreg. Average.	Barley. Duty.	Oats. Weekly Average.	Oats. Aggreg. Average.	Oats. Duty.	Rye. Weekly Average.	Rye. Aggreg. Average.	Rye. Duty.	Pease. Weekly Average.	Pease. Aggreg. Average.	Pease. Duty.	W...
1847.	s. d.	s. d.	Free.	s. d.	s. d.	Free.	s. d.	s. d.	Free.	s. d.	s. d.	Free.	s. d.	s. d.	Free.	s.
Feb. 6.	73 10	70 7	...	53 5	50 9	...	33 0	30 2	...	55 9	51 1	...	57 8	53 9	...	54
13.	71 7	71 10	...	51 10	52 0	...	32 8	31 1	...	56 8	52 8	...	56 11	54 11	...	53
20.	71 8	72 7	...	53 6	53 2	...	31 11	31 9	...	51 3	53 6	...	55 10	55 8	...	53
27.	74 7	73 4	...	55 0	54 0	...	32 4	32 2	...	55 11	54 5	...	57 5	56 7	...	53
Mar. 6.	74 4	73 6	...	54 11	54 1	...	32 3	32 5	...	55 10	55 2	...	56 1	56 9	...	53
13.	74 2	73 4	...	52 10	53 7	...	31 2	32 3	...	55 1	55 1	...	54 11	56 6	...	52
20.	75 10	73 8	...	51 10	53 4	...	31 3	31 11	...	56 8	55 3	...	57 2	56 5	...	51
27.	77 0	74 7	...	51 4	53 3	...	31 6	31 9	...	56 0	55 2	...	58 9	56 8	...	51
Apr. 3.	77 1	75 6	...	51 3	52 10	...	31 8	31 8	...	57 7	56 3	...	56 10	58 10	...	51
10.	74 5	75 6	...	49 8	52 0	...	32 7	31 9	...	54 10	56 0	...	56 0	56 7	...	50
17.	74 1	75 5	...	48 4	50 11	...	29 7	31 4	...	56 1	56 1	...	50 7	55 8	...	49
24.	75 10	75 9	...	48 5	50 2	...	29 6	31 0	...	53 6	55 9	...	52 4	55 3	...	49
May 1.	79 6	76 4	...	49 6	49 9	...	30 11	31 1	...	55 6	55 7	...	52 11	54 7	...	51
8.	87 10	77 1	...	51 0	49 8	...	31 6	31 0	...	58 3	56 0	...	54 11	53 11	...	53
15.	85 2	78 6	...	52 7	49 11	...	32 11	31 2	...	58 7	56 1	...	55 0	53 7	...	54
22.	94 10	81 10	...	55 10	50 11	...	34 3	31 6	...	69 4	58 7	...	60 11	54 5	...	57
29.	102 5	86 7	...	56 5	52 3	...	36 3	32 7	...	73 11	61 6	...	59 3	55 11	...	59

FIARS PRICES of the different COUNTIES of SCOTLAND, for Crop and Year 1846, by the Imperial Measure.

ABERDEENSHIRE.

	Imp. qr.
Wheat, without fodder	56/4
—— with fodder	
Barley, without fodder	38/3
—— with fodder	44/9
Bear, First, without fod.	35/8
—— with fodder	42/2
—— Second, without fod.	33/4
—— Second, with fodder	39/10
Oats, First, without fodder	30/6
—— First, with fodder	38/
—— Second, without fod.	29/
—— Second, with fodder	36/6
Pease	41/10
Beans	41/8
Malt	
Oatmeal, per 140 lbs.	23/10

AYR.

Wheat	62/11½
Barley	39/8¾
Bear	37/6
Oats	28/3½
Beans	59/5½
Oatmeal, per 140 lbs.	27/3

ARGYLE.

Wheat,	68/
Barley	35/8
Bear	38/
Oats	33/8
Beans	51/
Oatmeal, per 140 lbs.	28/

BANFF.

Wheat	64/6
Barley, without fodder	38/
—— with fodder	42/6
Bear, First, without fod.	35/
—— with fodder	39/6
——, Sec., without fod.	33/
—— with fodder	37/6
Oats, Potato, without fod.	31/1
—— with fodder	36/1
—— Com., without fod.	30/1
—— with fodder	35/1
Pease	50/
Beans	46/6
Oatmeal, per 140 lbs.	22/8

BERWICK.

Wheat	62/2¼
Barley, Merse	37/7 4/12
—— Lammermuir	38/5
Bear	
Oats, Merse	32/6 3/12
—— Lammermuir	28/10 9/12
Pease	52/4 6/12
Oatmeal, per 14 lbs.	2/5 6/12

BUTE.

Wheat	
Barley	
Bear	
Oats	
Beans	
Oatmeal, per 140 lbs.	

CAITHNESS.

Bear	30/
Oats, Potato	27/1
—— Early Angus	26/7½
—— Dun	26/6
—— Black	
Oatmeal, per 140 lbs.	23/3

CLACKMANNAN.

Wheat	64/0¼
Barley, Kerse	40/9¾

CLACKMANNAN, (Continued.)

	Imp. qr.
Barley, Dryfield	32/2¾
Oats, Kerse	32/8¼
—— Dryfield	33/10
—— Black	
Pease and Beans	62/6
Malt	62/11¾
Oatmeal, per 140 lbs.	27/2½

DUMBARTON.

Wheat	60/5
Barley	38/11
Bear	37/9
Oats	33/4
Pease and Beans	55/2
Oatmeal, per 140 lbs.	27/5

DUMFRIES.

Wheat	
Barley	
Bear	
Oats, Potato	
—— White	
Pease	
Beans	
Rye	
Malt	
Oatmeal, per 140 lbs.	

EDINBURGH.

Wheat, First	64/
—— Second	58/
Barley, First	41/4
—— Second	38/
—— Third	35/
Oats, First	35/
—— Second	32/6
Pease and Beans	56/3
Oatmeal, per 280 lbs.	52/6

ELGIN & MORAY.

Wheat	65/1¾
Barley	39/1
Oats	31/0¾
Pease and Beans	46/10¾
Rye	35/9¾
Oatmeal, per 112 lbs.	18/1½

FIFE.

Wheat, White	61/11¾
—— Red	56/1¾
Barley	36/7½
Bear	
Oats	32/8½
Pease and Beans	48/9
Malt,	62/9½
Rye	40/8½
Oatmeal, 140 lbs.	25/11½

FORFAR.

Wheat	65/5
Barley	40/2
Bear	39/6
Oats, Potato	33/8
—— Common	33/
Pease and Beans	49/5
Rye	40/
Oatmeal, per 140 lbs.	25/6

HADDINGTON.

Wheat, First,	69/2¾
—— Second	63/11½
—— Third	58/8¾
Barley, First	44/5¾
—— Second	40/1¾
—— Third	37/3½
Oats, First	39/6
—— Second	34/0¾
—— Third	30/6¾

HADDINGTON, (Continued.)

	Imp. qr.
Peas and Beans, First,	
—— Second,	
—— Third,	

INVERNESS.

Wheat, without fodder	62/8
—— with fodder	70/
Barley, without fodder	39/2
—— with fodder	45/6
Bear, without fodder	37/9
—— with fodder	44/
Oats, without fodder	31/8
—— with fodder	40/
Pease	
Beans	
Oatmeal, per 112 lbs.	20/

KINCARDINE.

Wheat, without fodder	62/9½
—— with fodder	72/9½
Barley, without fodder	37/0¾
—— with fodder	44/6¾
Bear, without fodder	34/1½
—— with fodder	41/7½
Oats, Potato, without fod.	32/
—— with fodder	41/
—— Com. without fod.	31/3¼
—— with fodder	40/3¼
Pease, without fodder	47/
—— with fodder	58/
Beans, without fodder	46/2
—— with fodder	57/2
Oatmeal, per 140 lbs.	24/4

KINROSS.

Wheat	58/
Barley, First	38/
—— Second	35/
Bear, First,	
—— Second	
Oats, White, First	32/2
—— Second	28/
—— Black, First	
—— Second	
Pease	46/9
Oatmeal, per 280 lbs.	50/10

KIRKCUDBRIGHT.

Wheat	67/4
Barley	41/4
Oats, Potato	32/4
—— Common	28/8
Oatmeal, per 140 lbs.	25/

LANARK.

Wheat, First	68/4½
Wheat, Second	61/5½
Barley, First	43/6¼
—— Second	39/3
—— Third	33/8½
Bear, First	38/5½
—— Second	35/1¼
—— Third	29/10¼
Oats, First	37/2
—— Second	30/8¼
Pease	64/10½
Beans	50/4½
Malt	77/
Oatmeal, per 140 lbs.	27/10

LINLITHGOW.

Wheat	62/6
Barley	41/3
Oats	33/1
Pease	55/8
Malt	63/
Oatmeal, per 140 lbs.	
—— per 112 lbs.	—

FIARS PRICES.

NAIRN.

	Imp. qr.
Wheat	65/
Barley, without fodder	38/6
—— with fodder	45/
Oats, without fodder	29/
—— with fodder	37/
Oatmeal, per 112 lbs.	18/6

ORKNEY.

Bear, per 368 lbs.	26/3
Malt, 140 lbs. with duty	20/
—— without duty	11/9
Oatmeal, per 140 lbs.	18/11

PEEBLES.

Wheat, First	
—— Second	62/0½
—— Third	
Barley, First	48/6¼
—— Second	41/11
—— Third	36/3¾
Oats, First,	36/10
—— Second	32/10
—— Third	30/9¼
Pease, First	62/5¼
—— Second	56/6¾
—— Third	51/5¼
Oatmeal, First,	28/6¾
—— Second	26/1¼
—— Third	24/3¼

PERTH.

Wheat, First,	62/9
—— Second	53/5
Barley, First	37/11
—— Second	32/8
Oats, First	32/9
—— Second	24/6

PERTH, (Continued.)

	Imp. qr.
Beans	49/7
Rye	52/
Oatmeal, per 140 lbs.	24/8

RENFREW.

Wheat, First,	63/5
—— Second,	
Barley, First	37/4¼
—— Second	36/1¼
Bear, First	33/0¾
—— Second	31/8
Oats, First	33/6
—— Second	32/
Peas,	60/
Beans,	59/4
Oatmeal, per 140lbs. First,	27/2¼
—— Second	27/0¾

ROSS AND CROMARTY.

Wheat, First	64/8½
—— Second	62/
Barley	38/2¼
Bear	40/6½
Oats, First	33/3
—— Second	31/7¼
Pease	55/2¾
Oatmeal, per 140 lbs.	23/9½

ROXBURGH.

Wheat	63/7$\frac{10}{12}$
Barley	38/10
Oats	31/1$\frac{8}{12}$
Rye	36/
Pease	52/8
Beans	52/0$\frac{6}{12}$
Oatmeal, per 140 lbs.	24/3$\frac{8}{12}$

SELKIRK.

Wheat	69/6

SELKIRK, (Conti

Barley	
Oats, Potato	
—— Common	
Pease	
Oatmeal, per 140 lbs.	

STIRLING.

Wheat	
Barley, Kerse	
—— Dryfield	
Oats, Kerse	
—— Dryfield	
—— Muirland	
Pease and Beans	
Malt	
Oatmeal, per 140 lbs.	

SUTHERLAN

Wheat	
Barley	
Bear	
Oats Potato	
—— Common,	
Rye	
Pease	
Oatmeal, per 140 lbs.	

WIGTON.

Wheat	
Barley	
Bear	
Oats, Potato	
—— Common	
Pease	
Beans	
Malt	
Oatmeal, per 280 lbs.	

We may inform our English readers, that Fiar Prices are the average prices of grain, as as every year, by the verdict of Juries, in every county of Scotland. The Juries are summoned in s ascertain, from the evidence produced to them, the average prices of the preceding crop. By th rents payable in grain, and similar contracts, are generally determined; but the main object is t into money the stipends (for the most part fixed at a certain quantity of grain) of the Scottish C

*** The Fiars Prices of DUMFRIES and BUTE will appear in next Number

ERRATA.

Page 404, No. XIV., second line, *for* stones *read* lbs.; and in the third line f top, *for* stones *read* lbs.

ON THE CONDITION OF THE AGRICULTURAL AS COMPARED WITH THE MANUFACTURING POPULATION.*

STATISTIC tables are, to the political and social inquirer, what retorts and crucibles are to the investigator of material nature; they furnish him at once with the data upon which he speculates, and enable him to test the accuracy of the hypotheses which he has formed. Existing regulations are judged of by the results which, during a series of years, an accurate statistic exhibits, and these results, again, are suggestive of measures to be adopted or repealed. The labours of the statistician are indeed neither more nor less than an extension to the social position of man—to his wealth and well-being—of that system of minute and accurate observation which, within the last seventy years, has worked such wonders in other departments of science. But if experiment and observation in natural science were long in assuming the important position which they merited, such has been still more strikingly the case in social investigations. A proof of this, and one of the most remarkable which could well be adduced, is the notorious fact, that it was not till 1801 that any regular census was taken of the inhabitants of this country, and the earliest enumeration in Ireland took place in 1813. The attempted approximations anterior to these dates, from Domesday Book downwards, were of the most loose and unsatisfactory description. Taxation was the only object which they were intended to accomplish; and indeed it is only from calculations founded upon the manner in which taxes at different periods are known to have been collected, that these approximations have been arrived at by investigators in our own times. The same seems to have been the object with which the Roman *lustrum* was instituted, and the periodical numberings of the people in the various states of Greece. No investigation into the physical and moral condition of the people at large was ever contemplated; and the only classes of which cognisance was taken, were precisely those in whose case such an investigation is in a great measure unnecessary. They were the wealthier classes—in short, those who could contribute something to the benefit of the state, not those whose degraded

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* Sixth Annual Report of the Registrar-General, 1845.—Seventh Annual Report of the Registrar-General, 1846.—Report on the employment of women and children in agriculture, 1843.—Minutes of Committee of Council on Education, 1845.—Twelfth Annual Report of the Poor Law Commissioners, 1846.—M'Culloch's Statistical Account of the British Empire.—Porter's Progress of the Nation, 1847.—First Annual Report of the Board of Supervision for the Relief of the Poor in Scotland, 1847.

and helpless condition called for her sympathy and protection. Since the beginning of the present century, great attention has been paid to all departments of statistical investigation, both in this country and on the Continent; while in this, as in all other practical subjects, America has kept pace with her European parents. A great stimulus was, no doubt, given to such inquiries by the immediate practical use to which they were turned by the rapidly increasing custom of life insurance, and other analogous speculations on the chances of fortune; and to this source may be traced directly many very important statistical labours. But a higher and nobler object has recently in many instances been in view, and an interest of an altogether different kind consequently begins to attach to them. They have no longer the special and immediate object of levying taxes, or speculating upon chances; but the grand and ultimate one of furnishing us with information which may enable us to increase the well-being of the whole mass of our fellow-citizens. Amongst the labourers in this useful department of social investigation in our own country, the name of the late Sir John Sinclair is at all times to be mentioned with honour, and the spirit of inquiry which he invoked has since been abundantly gratified by the innumerable Parliamentary Commissions which have been appointed from time to time to investigate questions of social interest—by the establishment of a general registration of births, deaths, and marriages in England—by the attempt which has recently been made to extend that measure to Scotland—by the attention which has been given to *medical* statistics; and in a hundred other ways. Something of life and spirit has thus been breathed into these dead and cumbersome calculations—they have begun to entwine themselves with our dearest interests both as men and as citizens, and to explain to us the causes of our happiness and of our misery.

At the same time, however, it must be confessed that the origin of these labours is still not a little apparent, both in the nature of the labours themselves, and in the character of those by whom they are usually undertaken. They are for the most part directed to externals merely; and comparative tables, which of all others are the most instructive in estimating the real condition of the different classes of the community, have been attempted only in a very few instances. The mind of a mere arithmetician is but little able to grapple with the complexity of a social or moral question, and the information which his labours furnish, is often inadequate to throw light upon it. Notwithstanding this disadvantage, however, a careful examination of the statistical works already before the public, will furnish the means of solving not a few questions of the highest importance; and if, in our wanderings through these labyrinths of facts and figures, we shall

succeed, as Bacon says, in wooing one single truth, we shall consider our labour to have been abundantly requited. When we speak of a truth, we mean, of course, one of Bacon's truths—something very different from a mere opinion; for, by opinions, when hastily adopted, even when they come from high quarters, we are usually disposed to set no great store. To account for this our want of faith, we may relate an incident, which, as it served to suggest, may also not inappropriately introduce the more immediate subject of our present investigation. One beautiful sunshiny day, a few weeks ago, we were seated under some bushes in one of the numerous creeks formed by the windings of the Forth, quietly enjoying the beauty of the scene, the breeze from the sea, and the Essays of the Right Hon. Thomas Babington Macaulay. The object of our more immediate study was his review of "Southey's Colloquies on Society," and after much well-merited ridicule which he heaped on the future Laureate for his ridiculous fancy of holding an imaginary conversation with Sir Thomas More, we came to the part in which he and Mr Southey are at issue as to the comparative prosperity of the agricultural and manufacturing populations of this country. That, if Mr Southey preferred the agriculturists, Mr Macaulay should prefer the manufacturers, did not astonish us very greatly, for we already saw that he was determined to differ with him on every possible occasion; and we were besides aware that an opinion running counter to that generally entertained by those whom he considers behind the age, is at all times agreeable to the mind of that right honourable gentleman. We proceeded, therefore, to read as follows:—

The poor-rate is very decidedly lower in the manufacturing than in the agricultural districts. If Mr Southey will look over the parliamentary returns on this subject, he will find that the amount of parish relief required by the labourers in the different counties in England, is almost exactly in inverse proportion to the degree in which the manufacturing system has been introduced into those counties. The returns for the year ending in March 1825, and in March 1828, are now before us. In the former year, we find the poor-rates highest in Sussex —about 20s. to every inhabitant. Then come Buckinghamshire, Essex, Suffolk, Bedfordshire, Huntingdonshire, Kent, and Norfolk. In all these the rate is above 15s. a-head. We will not go through the whole. Even in Westmoreland and the West Riding of Yorkshire, the rate is not more than 8s. In Cumberland and Monmouthshire, the most fortunate of all the agricultural districts, it is at 6s.; but in the West Riding of Yorkshire, it is as low as 5s.; and when we come to Lancashire, we find it at 4s., one-fifth of what it is in Sussex. The returns of the year ending in March 1828, are a little, and but a little, more unfavourable to the manufacturing districts. Lancashire, even in that season of distress, required a smaller poor-rate than any other district, and little more than one-fourth of the poor-rate raised in Sussex. Cumberland alone, of the agricultural districts, was as well off as the West Riding of Yorkshire.

These facts, adds Mr Macaulay, seem to indicate that the manufacturer is both in a more comfortable and in a less dependent situation than the agricultural labourer.

These were indeed startling statements, and the conclusions which Mr Macaulay drew from them seemed at first sight almost inevitable.

Were all our early prepossessions, then, in favour of a country life, to be rudely swept away by one single extract from the report of the Poor-law Commissioners? Were the "*Agricolæ prisci, fortes parvòque beati,*" to be classed from henceforth with witches and the other creatures of superstition and vulgar error? and did *Horace's Odes* and *Virgil's Georgics* owe their whole charm to the circumstance of their being misrepresentations of the real condition of affairs? In one word, was every man, woman, and child who had written, thought, or talked upon this subject, in error, up to the happy hour when, from the perusal of this magic report, the light of truth burst in upon the mind of the Right Hon. Thomas Babington Macaulay? We gazed upon the comfortable and lightsome abodes of the peasantry which surrounded us, with the blue sky above them, and the sunny fields before them, with the yellow corn gently waving in the autumn wind; we listened to the merry accents which arose from a field of reapers, whose sturdy bodies were bent in a labour which seemed to them almost a pastime; and we contrasted the sights and sounds which were thus presented to us, with those which a visit to a great manufacturing city on the occasion of a recent circuit, had brought under our observation.

We recalled, with painful vividness, the dirty, diseased, and half-developed wretches who, in a dingy atmosphere, there crawled along the filthy streets, and whose dreadful precocity in vice had rendered many of them bloated and swollen debauchees; others, shrunk and withered libertines before they had reached the age of a natural puberty. We thought of the hundreds whom we had seen there breathing an artificial and unwholesome atmosphere, and engaged in a labour which brought exhaustion, without that degree of physical vigour which is the natural recompense of exertion. We thought, above all, of the vast numbers of persons in early life of both sexes, whom we had seen take their place on the seat of infamy in the dock of the circuit court of justiciary, and we said, Is it possible our right hon. friend is truly representing the condition of the people of these realms? We took courage from the doubt, and proceeded to the following beautiful little specimen of special pleading:—

As to the effect of the manufacturing system on the bodily health, we must beg leave to estimate it by a standard far too low and vulgar for a mind so imaginative as that of Mr Southey—the proportions of births and deaths. We know that during the growth of this atrocious system, this new misery (we use the phrase of Mr Southey), this new enormity, this birth of a portentous age, this pest which no man can approve whose heart is not seared, or whose understanding has not been darkened, there has been a great diminution of mortality, and that

this diminution has been greater in the manufacturing towns than anywhere else. The mortality still is, as it always was, greater in towns than in the country; but the difference has diminished in an extraordinary degree. There is the best reason to believe (Mr M. does not tell us what it is) that the annual mortality of Manchester, about the middle of the last century, was one in twenty-eight. It is now reckoned at one in forty-five. In Glasgow and Leeds a similar improvement has taken place. Nay, the rate of mortality in these three great capitals of the manufacturing districts, is now considerably less than it was fifty years ago over England and Wales, taken together, open country and all.

Now, when we proceed to analyse this curious passage, the first fact which strikes us as remarkable, is the dexterity with which Mr Macaulay contrives to shift his ground whenever it becomes inconvenient for his position. In the first place, he enlists our confidence by professing the utmost contempt for such holiday reasoners as Mr Southey, and telling us that *his* estimate is to be rested on the solid foundation of a comparison of the number of births and deaths. Of course we suppose that it is to be a comparison of the number of births and deaths in our manufacturing and rural districts at the present time, or at least of those of our manufacturing and non-manufacturing towns. But nothing of the kind. Mr Macaulay proceeds to state on his own authority (for this, we believe, is what he means by the best), that the mortality of Manchester is considerably diminished during the last fifty years, and that the like has been the case with the other manufacturing towns—nay, he goes further, and says (on the same authority we presume), that it is less than it was over the whole of England half a century ago. Now, what will our readers say to this way of proving that "the manufacturer is both in a more comfortable and less dependent situation than the agricultural labourer," when we inform them—not on Mr Macaulay's authority, or on our own, but on that of the Registrar-general for England—that the expectancy of life in Manchester is no less than 16 years under the average of all England at birth—13.6 at one year, 6.5 at 10, 6.6 at 20, 6 at 40? — (*Seventh Annual Report of the Registrar-general*, page 338.)—Or when we recall to their recollection a statement by the Bishop of London in the House of Lords, not many months ago, on the authority of Mr Fletcher, "a medical man, and a most able and benevolent individual, who had made a close investigation of this subject"—"that the average duration of life of the factory operative is somewhat less than one-half that of other operatives in the same district?"

We accept Mr Macaulay's own criterion of prosperity, viz. the duration of life, as probably the safest by which we can be guided; and this is the result which meets us at the very first blush of the inquiry! So much, then, for the fidelity of this practical investigator. But, as we have mentioned the names of Mr Macaulay and Mr Southey as the representatives of the two

opposite schools, it may be well to remark, before dismissing them, that we are very far from dissenting entirely from the views of the one, and still farther from thoroughly concurring in those of the other.

We by no means regard the whole manufacturing system as a monstrous and incurable disease, beyond the reach even of alleviation; at the same time we are, if possible, still farther from subscribing to the doctrine, that this is a manufacturing country once for all—that our advancement and greatness depend upon our becoming day by day more exclusively so—that agriculture is an interest of secondary importance—and the gradual diminution of the agricultural population a statistical fact which we must hail with joy as a proof of our growing national prosperity. That the population of our towns, particularly of our manufacturing towns, is increasing much more rapidly than that of our rural districts, is a fact of which we believe there cannot be a doubt. Mr M'Culloch has calculated, that while, during the ten years ending 1830, the entire population increased at the rate of 16 per cent, that of the great towns increased at the rate of nearly 23 per cent. The question then comes to be, ought this to be a cause of rejoicing, or the reverse? Is it or is it not a healthy manifestation in the body politic? This question, we believe, can only be answered by our arriving at something like a positive estimate of the comparative well-being, both physically and morally, of these two classes of the population.

The true index of national prosperity is to be found neither in the quantity of food produced, nor in the number of persons who are kept from starving, but in the number of those who are placed in such circumstances as to render their development as human beings possible. It is not enough that a man is born into the world, and that he does not die of absolute want. The forester does not ask himself how many stunted saplings he can preserve alive on the surface of the soil, but how many stately trees he can rear. The man who is prevented by his position in life from attaining to the full period of human existence, and whose premature decay shows that even during the period which he has passed in this world, he has never attained to the vigour of a normal manhood, cannot be said ever to have existed to any good purpose at all. His whole life has been a standing reproach on that condition of society which rendered such an existence possible.

The aggregate amount of *happiness* enjoyed, if we could ascertain that, would be the true index of a true prosperity; and is it not very possible that ten men in good health and comfortable circumstances may enjoy a greater amount of happiness during their lives, than a hundred who, in disease and misery, have preserved themselves just above the starving point?

There are many reasons, besides the example of Mr Macaulay, why, in forming this estimate, we greatly prefer the life-tables to the poor-rates. In the first place, we believe it to be very certain that in the general case relief is much more readily given in a rural district, by an inspector acquainted with the individual circumstances of every applicant, than in a large town; and that thus the poor-rate is swelled in rural districts with numbers of names which never would have been placed upon it in towns. In many country parishes with which we are acquainted, relief is given wherever a family has fallen below the average condition of their neighbours; whereas, in towns, we are convinced that in many a case of destitution, which, though not amounting to starvation, is such as ultimately to shorten life, no relief is ever granted at all. Another circumstance is, that in healthy districts, where persons attain to a great age, the very circumstance of age is regarded as a sufficient claim for relief; and their good, and not their evil fortune, may thus be said to be the cause of their swelling the poor-rate. Besides, we can scarcely imagine, on the whole, a better proof of a tolerably prosperous life, than that it has been long in the land. Longevity is the promise which was formerly given to those who honoured their parents; and in whatever light we may view it, it is inconsistent with the idea either of great want, of great misery, or of great vice, for each and all of these tend directly to shorten life; and whatever may be the case with solitary individuals, their effects will certainly be apparent in the mass.

With regard, then, to this criterion of prosperity, we have already stated, on the authority of the Registrar-general, that Manchester, which may be taken as the head-quarters of this new and daily increasing *town* population, stands to a most deplorable extent under the average of all England. But we do not stop here. We are informed, on the same authority (*7th Report*, 1846, p. 20), that "the *lowest* mortality in any division in any one year was 1.802 per cent in 1843 in Wales and Monmouthshire; the *highest* mortality 2.957 per cent in 1840 in Lancashire and Cheshire;" the former districts being altogether rural; the latter being, first, Lancashire, of which we need say nothing; and the second containing the large manufacturing places of Macclesfield and Stockport.

Again, let us make use of a test recently adopted by a writer on this subject in the *Quarterly Review*. Let us take twelve of the most purely agricultural counties—Beds, Bucks, Cambridge, Essex, Hereford, Hants, Lincoln, Norfolk, Oxford, Rutland, Suffolk, Sussex—and contrast the mortality in these counties with that in West Yorkshire and Lancashire, where manufactures most prevail. The result is, that whereas in the former counties the

proportion is 1.07 per cent, in the latter it is 1.69, or, in other words, for every two deaths among the purely agricultural population, three take place in the manufacturing districts. But if, instead of taking the whole counties, we take the towns simply, and contrast them with the rural districts, the mortality is still more appalling. In 1831, the population of Birmingham, Leeds, Manchester, and Salford, was 483,430, and the deaths in 1839 were 17,250, or 3.56 per cent; that is to say, in round numbers, seven deaths to two in the twelve agricultural counties.

But it is not only when compared with the rural districts, or with the whole of England, that Lancashire falls below the average; the same, though not of course to the same extent, is the case when we contrast it with the towns; nay, even with the metropolis itself. In London, in 1837, the deaths of males were 2.762 per cent; whereas, in Lancashire, *open country and all*, they were 2.795 per cent; and indeed, when we glance along the columns of the whole table, we find that not one single county in England equals, and very few of them even approach, the mortality of Lancashire. Yet the climate of Lancashire is reputed salubrious, and no other peculiarity in its condition presents itself to observation, except that more than two-thirds of its whole population are employed in manufactures.

Now, as to the *decreasing* mortality in our manufacturing towns, of which Mr Macaulay and those of his school so hopefully speak, we shall beg to bring under their notice the following facts, which, for the sake of variety, we shall borrow from the statistics of our own end of the island. They are from a table prepared by the instructions of the Town Council of Glasgow. They are given for different ages; but, not too greatly to tax the patience of our readers, we shall give them briefly for *all ages*. The deaths, then, between the years 1821 and 1835, were to the 100 in the whole population, as follows:—

MALES.			FEMALES.		
1821–1825	1826–1830	1831–1835	1821–1825	1826–1830	1831-1835
2.78	2.91	3.59	2.37	2.40	2.93

And for the last four years previously to 1837, exclusive of the year of cholera—males, 3.31; females, 2.62. In 1840 the mortality had risen so high as 3.38 over the whole population; thus showing a gradual but constantly increasing mortality, to no less an extent than twenty per cent every five years, in this almost purely manufacturing city.

When we bring before our eyes an evil of this dreadful magnitude—when we perceive, for example, as in this last instance, that ten of the inhabitants of Glasgow die for every three in the agricultural counties of England; and when we reflect, moreover, that the evil is one which is growing every day and every hour under our very eyes, we shall scarcely deserve the imputation of any unreasonable gloominess of temper, if we refuse to view the manufacturing system in those bright colours with which its admirers have invested it.

But let us take another criterion, and one which will perhaps come even more powerfully home to the minds of our moral and religious readers—we mean the extent of crime. We find from a table (*M'Culloch's Statistical Account of the British Empire*, vol. i. p. 567), that the number of persons committed for trial, or bailed, in Lancaster, was one to 503; whereas, in the whole of England, it is only one in 631. In the city of Bristol crime seems to be at the maximum, the number being one in 274. Middlesex (including Surrey) and Warwick also stand below Lancashire in the scale of crime; but, with these exceptions, it is under all the other counties. Nor does the prospect in this direction brighten as we advance. Crime has increased at a vastly more rapid rate in the manufacturing than in the agricultural districts. From the "tables showing the number of criminal offenders in the year 1842," we find, that the increase in the manufacturing and mixed districts was as 83.83 to 16.12 per cent in the agricultural counties, or as five to one.

In Scotland, also, the same deplorable results present themselves. From 1836 to 1841, the general increase of crime was 17.96 per cent, but it was 36 per cent in the great manufacturing districts of Lanark and Renfrew. That the total increase in the number of convictions during the period to which we have referred, and since, is in some measure to be attributed to the relaxation of punishments, which induces prosecutors to persevere, and juries to convict, cannot be doubted; still, this touches not our present argument, since the effect is of course the same upon all criminals, from whatever part of the country they may chance to come.

The greater efficiency of the police, too, in most parts of the country, may give an apparent increase beyond that which has actually taken place, but this must also affect the rural districts since the establishment of the rural police, quite as much as the manufacturing districts. When we remember, also, that during the war it was not unfrequent to pass over offences of a lighter nature, on condition of the offender entering the army or navy, and add this as a third cause for the apparent increase of crime, we shall probably be of opinion, that the real increase does not so greatly exceed that which the increased population would lead

us to expect, as would at first appear: Still, the increase, such as it is, is almost entirely in the manufacturing districts.

Wherever you have a dense population, with precarious means of subsistence, there you have a vicious population also. Cut off from the enjoyments and the hopes which belong to a more prosperous condition, with neither character nor comfort to lose, it is scarcely to be wondered at, that they should rush into crimes which hold out to them at least the chance of a momentary relief. We see that the amount of crime, for the most part, corresponds directly to the external condition of the people; and it cannot be doubted that the increase of a reckless class in this country, partly from the scarcity of food among our own people, and partly from the large importation of misery from Ireland, was the cause of the criminal lists of all the recent circuits in Scotland being swollen to such an unusual size. But it is among the young chiefly that the excess of crime in the manufacturing districts, and in town populations generally, is remarkable. How rarely have any of us seen a country boy or girl placed at the bar of any of our higher criminal courts! and what lawyer has not had occasion to spend a considerable portion of his early professional life in defending urban juveniles from the most atrocious charges? Nor is it difficult to discover the reason why the contagion of crime, whilst it seizes hold of the ragged frequenter of the lanes of a crowded town, leaves the rustic child almost entirely free from its influence. From the reports published by the commissioners appointed by the Government to inquire into the "employment of women and children in agriculture," in 1843, we learn, that, in the opinion of the innumerable clergymen, medical men, farmers, country gentlemen, and even peasants themselves, who were examined, the employment of children in rural labour is the very reverse of prejudicial, either to their health or morals. One gentleman says, "They are generally strong and hearty, and better in health from the employment." The only objection to their employment in field labour, at the early age at which their parents, particularly if the family be large, often find it necessary to set them to work, is, that it deprives them to a certain extent of the benefits of education. This, however, is a disadvantage by no means arising from their being agriculturists, but simply from their belonging to the lower classes—a disadvantage, moreover, from which they can never be freed in a country like this, where the remuneration for a man's labour is never likely to rise greatly above that which is necessary to support himself, and those who are positively dependent upon him.

But, although compelled to work at an early age, the peasant's child is neither poor nor miserable. We are told by the Report, "that from the time they begin to work, however young they may be, they very nearly, if not wholly, support themselves."

We know nothing indeed which more thoroughly refutes the arguments of those who would fain convince themselves and others that the agricultural population of this country is as badly off as the operatives, than the Report to which we have here referred. It is compiled by several gentlemen of the highest intelligence, and the most perfect impartiality—and the facts which it contains are the results almost entirely of their individual investigations. The Part (or rather the Report, for the whole Report is composed of a number of minor ones distinct from each other) which has reference to the counties of Wilts, Dorset, Devon, and Somerset, is by Mr Alfred Austin; that on Kent, Surrey, and Sussex, by Mr Henry Halford Vaughan; on Suffolk, Norfolk, and Lincoln, by Mr S. C. Denison; and on Yorkshire and Northumberland, by Sir F. H. Doyle. The districts and the investigators are thus as varied as well may be; and still the picture which is presented, when viewed as a whole, is favourable throughout to the condition of the people, at least of those of them who are employed in natural field-work, on a natural system. The opinions of the witnesses as to the effects of outdoor labour on the health of women, are almost unanimously favourable. One medical witness says:—

We have found much more disease in women of sedentary habits of the same class, such as those employed in button-making and household service. Where women have no outdoor exercise, chlorosis, constipation, and indigestion occur, which are very uncommon with women who labour in the fields. Women who labour in the fields like men, if exposed to too much wet and cold, are subject to rheumatism and catarrhs. Women in particular should, especially at certain times, avoid such exposure. But, generally, outdoor employment is extremely conducive to regular habits of body in women; and, from the want of such regularity, women of the same class of life in towns, or at service, and who do not work out of doors, suffer a great deal.

The following observations of Mr Austin, regarding its effects on their morals, which he tells us are the result of all that he saw or heard on the subject, are altogether consistent with our own experience:—

There are no very apparent effects upon the morality of women from their working in the fields; very frequently they are active, energetic, and well-disposed women, working from the sole desire of increasing the means of subsistence of the family, and personally undergoing the labour of their employment for that object. Their motive being thus meritorious, is hardly consistent with any great degree of immorality. Instances of immorality on the part of married as well as single women thus employed, occur, but not more frequently, as far as I could ascertain, amongst them than amongst women of the same class who do not work at the same labour. There is no doubt that the mixed employment of men and women in hay-making, and perhaps in the corn-harvest, tends to immorality. Hay-making is a season of comparative license. Hard work is expected by the master; and if it is performed, he overlooks conduct on the part of the work-people which he might not suffer to pass unnoticed at other times. Drink, and frequently food, is plentifully supplied to stimulate to work, and gaiety is promoted by every means.

The topics of conversation, and the language that is used amongst men and women, young and old, is described as coarse and filthy. That breaches of morality occur, cannot be doubted; indeed, there is plenty of evidence that they actually take place.

But one-half of the women and girls employed in the hay-field are never engaged in any other kind of farm-work, and the licentiousness of that season, as far as the women are concerned, would appear rather to proceed from those occasionally employed. And he adds afterwards—I believe the more immoral of the women employed in agriculture, particularly the women only occasionally employed, as in hay-making and at harvest, are from neighbouring villages, and that the steady and better, and also the largest portion of the women regularly employed in the fields, are from the detached cottages, rather than the villages.

The allotment system, which has been adopted to a great extent in Wiltshire, Dorsetshire, and Devonshire, seems on the whole to have had a very beneficial influence upon the condition of the peasantry, and is well worthy of the consideration of those who are of opinion that the supporting of as large a number of the population as possible, in comfort and plenty, in the country, is an object of equal importance with that of raising, it may be, a little more corn to feed the inhabitants of towns. Where agricultural improvements can be effected only at the expense of driving half the population of the district into great towns, we have always doubted their being a benefit; and though a larger population may thus be kept alive between the three seas, we greatly fear that a larger population is not supported in such a condition as to render life really a blessing.

We repeat what we said at the outset, that the lives of ten men in health and comfort are worth more, both to themselves and the community, than the lives of twenty men in sickness and starvation; and it is the number of the former, and not of the latter, that we are to endeavour to increase.

For the attainment of this object, the allotment system seems as well suited as any which has yet been devised.

The rent, says Mr Austin, is the same as that which is generally paid for land of the same quality in the same neighbourhood, when let in larger lots as farms. The average produce of an acre of ground planted with potatoes, may be taken at about 300 bushels. Half an acre of allotment, therefore, will yield enough to give a family 160 lbs. of potatoes a-week during the whole year, or about 3lbs. a-day each to a family of eight persons. The average rent of half an acre of ground varies from 15s. to 25s. a-year; and half an acre is not too large to allow of its being managed by the labourer, assisted by his wife and children, without prejudice to his ability to work properly for his employer. Generally speaking, the allotments do not contain so much as half an acre. They are, however, granted commonly with reference to the number of the labourer's family; and, in the majority of cases, there may be about half an acre to six or seven persons. The ground, however, is not always entirely planted with potatoes, a portion of it being very commonly used for the growth of other vegetables, and frequently of a little corn. . . Another source of the labourer's income, not derived directly from his employer, is the keeping a pig, a very usual practice in these counties. I believe that the allotment system, and also the common custom of allowing the labourer a potato-ground in certain districts, where he has no allotment, have very much encouraged this practice, as the facilities

for feeding and fattening the pig have been much increased. Straw for the pig is also very frequently given by the master, which is again of value as manure afterwards, for the garden or allotment. It is generally reckoned that keeping a pig is worth sixpence a-week to the farm-labourer.

By means of this system, almost every possible inducement to better his condition is held out to the labourer—above all, it is rendered hopeful. He knows, that, with a reasonable amount of industry and frugality, the means of comfort and happiness for him and his family are within his reach. The feeling of property adds to his self-respect. He is no longer an outcast—he holds on by something to that country, of which a part, a small one indeed, but still a part, has been allotted to him; and he becomes a peaceful and contented subject—a sort of conservative in his way, because he does not care to disturb a state of things in which he finds himself well. He is a faithful servant, for it is for his interest not to quarrel with his master; and as there is, when circumstances have not affected them too unfavourably, rather more of love than of hatred in the tempers of most men, his domestic affections flow over upon all who surround him, not forgetting even his pig. His condition, in short, is about as good as that of any one can be who lives by labour; and if to the above advantages we add a pretty, managing wife and a rosy-cheeked family, it will not be very difficult to imagine his becoming an object of envy, even to those whom fortune has placed many steps higher on the social ladder.

But if we have praised the allotment system, it is probably the only system which has been adopted with agricultural labourers upon which we shall feel disposed to bestow our commendations; and these it has merited rather from its being a return to a more natural state, than a step in advance into the region of artificiality. The compulsory parish apprenticeship system, even in its present modified form, seems as if it were intended to subvert every regulation which God has made for rearing up men to maturity. If a child who is brought up as an apprentice, were to grow into a being morally and physically well developed, we should say that truly the age of marvels had not ceased. Deprived in childhood both of the comforts and affections of a home, he is taught from the first to regard himself as a species of public nuisance. We can scarcely imagine a system so utterly indefensible, prevailing to a great extent in many parts of England in our own time; and when we read the account of it with which Mr Austin has favoured us, it seems to us as if we had got hold of a page of an old anti-slavery tract. He describes it thus :—

At the age of nine, children, when apprenticed, are taken away from their parents by the parish officer, not to be restored to them again during childhood. *Neither parents nor children are consulted;* they are separated by an act of law against which there is no appeal. The parents may be examined, *if the magis-*

trates think fit, with respect to their child being bound to the particular master proposed; but they cannot object to its being apprenticed altogether. During the apprenticeship, the parents may, if not prevented by distance, see their child; but the opportunities of their doing so depend practically on the master. All other connexion between them and the child is broken off. They have no control over it; they cannot object to the way in which it is brought up; nor can they interfere, unless it be to claim protection from positive ill treatment.

Any system more thoroughly demoralising, both for parents and children, it would be hard to contrive. A foundling hospital does not approach it in atrocity; for there the tie which is broken is one rising little above mere animal feeling, whereas, at nine years old, or even much earlier in childhood, a parent is, or ought to be, bound to his child by a thousand sympathies. The effect is such as might be anticipated:—

They (the parents) cease to consider their children, when once apprenticed, as part of their family; and the relief afforded to the parents in the removal of their children is regarded by them as an advantage. . . . . The apprentice, without any merit of his own, is placed in a situation where he lives better than the other children of his own class; he knows that the parish has placed him in that position, and that his remaining in it does not depend upon his exerting himself to the necessary degree for supporting himself. Twelve years thus spent frequently inure him to the idea of subsisting at the expense of other people, and habituate him to the demoralising practice of living on the parish. All feelings of independence are frequently rooted out before his apprenticeship expires; and without shame or hesitation, at subsequent periods of his life, he looks to the parish for support.

By the master, the apprentice is looked upon as a burthen, and treated as a slave—always with indifference, sometimes with cruelty; for where actual violence has not been committed, the magistrate cannot of course interfere practically; and we need none of us to be told how much cruelty may be inflicted short of actual violence. The apprentice does not live in his master's house in consequence of a contract voluntarily entered into, which might induce generosity on the one side, and gratitude on the other. His position is essentially a degraded one. Despised by the children of his master, and looked down upon even by the hired servants in the house, he is the inferior of every one with whom he comes in contact; and the influence of his depraved habits, the result of his position, we are told by Mr Austin, is considered by the farmers to be very prejudicial to the other members of their households.

The arguments in favour of the system are obvious enough—that, by being removed from the contamination of his home, and placed in circumstances of external comfort, among a class of persons whose condition is superior to his own, he thus breathes a purer atmosphere, and imbibes something of a higher morality. But such can never be the case so long as he is brought in contact with others only in this degraded character. No man will learn to be a freeman by being made a slave. If his condition in his

own family is bad, we must try to improve it, and thereby to act upon him; but to tear him away from it, is to violate one of the plainest institutions of nature, and to injure irreparably both it and him. Of this system, and the still more atrocious one to which we shall presently refer, we fortunately have had no experience in Scotland, and earnestly may we pray to be preserved from all such systematising.

In his report on the counties of Suffolk, Norfolk, and Lincoln, Mr Denison, after speaking in the highest terms of praise of the allotment system, which, we are happy to find, he says is there becoming general, refers to what is called the gang-system. His description of it is as follows:—

> Suppose a farmer in, or near, Castle Acre, wishes to have a particular piece of work done, which will demand a number of hands, he applies to a gang-master at Castle Acre, who contracts to do the work and to furnish the labour. The bargain is made with the gang-master, and it is then his business to make his bargain with the labourers. He accordingly gets together as many hands as he thinks sufficient, and sends them in a gang to their place of work. If the work, as usually happens, is such that it can be done by women and children, as well as men, the gang is, in that case, composed of persons of both sexes, and of all ages. They work together, but are superintended by an overseer, whose business it is to see that they are steady to their work, and to check any bad language or conduct. The overseer usually goes with the gang to the place of work, and returns home with them when they leave off for the day.

On paper, as Mr Denison remarks, this has no such very monstrous appearance; when we come to examine into its practical working, however, we shall find that its effects on the labouring classes are very deplorable. The gang-master is almost invariably a peasant who, by some degree of ability and cunning, has raised himself to the position of being able to employ others on speculation, and his only object, with regard to his gang, is to get out of them the greatest possible amount of labour for the smallest possible pay. He contracts to do his work by the piece, and consequently he makes his gang work as hard by compulsion as they would do freely were they working by the piece on their own account, while, in reality, they are no more than day-labourers receiving *day-labourers' wages.* The farmer thus gets his work done as quickly as though it were done by the piece, and the gang-master gets the extra profit which the labourer usually derives from piece-work. The distance also to which women and children are often compelled to walk before commencing their work, is felt to be a great hardship; and if the day should be wet, they are obliged to walk back again without getting either work or pay, whereas a farmer would probably endeavour to employ them in his barn or yard. One of the greatest evils of the system is, that it effects a separation between the farmer and his work-people, which often may induce him to shut his eyes to conduct on the part of the gang-master towards those in whom he takes

no interest, very different from what he would himself pursue towards his immediate dependents. The effects of the gang-system upon the morals of the females are said to be deplorable. We quote the words of one of the overseers of the gangs, as reported by Mr Denison :—

I believe that owing to ganging, seventy out of one hundred girls are very imprudent girls—prostitutes. They get working with the lads in the day-time, and make appointments at night; but still, if you were to come in among them when they are at work, you would not know but that they were very prudent women and girls. I should not like myself to take a wife out of the gang.

The evils of the system are pretty well summed up in the evidence of a woman of the name of Mary Churchman :—

It throws the whole labouring population into the power of the gang-master, who, if he be a low, hard man, illustrates the proverb, that no tyranny is so grinding as that of "the poor man who oppresseth the poor." He has neither the will nor the power much to mend their condition—he may, on the other hand, exact any amount of toil from them, or any conditions he pleases.

Such a system must have effects almost diametrically opposite to those which we have attributed to the allotment system, by totally eradicating those feelings of independence and self-respect which the other tends so largely to foster. As a necessary effect, if not also a cause, of this atrocious system, we find that education in this part of the country is at the lowest possible ebb, very few of the gang-labourers being able even to read.

No such system as this has ever existed in Scotland, and we are pretty sure would not be tolerated either here or in any of the northern counties of England. From what cause it may originally have arisen, we know not; but certain it is, that the ideas of the inhabitants of the northern part of the island have altogether a different elevation from that which we usually find among the peasantry of the south of England. They have risen too high to bear a system of slavery. On this subject we find some very interesting remarks in the conclusion of Sir F. H. Doyle's report on the counties of York and Northumberland :—

In contrasting the condition of the peasantry of the southern, with those of the northern parts of the kingdom, it would be highly improper to pass over unnoticed, the superior education of the latter, and the effect which is produced by it upon their worldly circumstances, as well as upon their moral and religious character. No greater stigma can attach to parents than that of leaving their children without the means of ordinary education, and every nerve is strained to procure it. In the school attached to almost every village, one finds children not only able to read and write at a very early age, but most expert in all the common rules of arithmetic, and not unfrequently capable of extracting the square and cube roots with great expedition and accuracy; and even the young men who labour in the fields all the day, often spend a couple of hours in the evening in school, in order to advance themselves in such acquirements. If occupation alone is a valuable antidote against idle and vicious habits, the acquirement of useful knowledge, and the cultivation of the human faculties, must be

still more so; and where these are prosecuted, not by gratuitous means, but by the produce of economy and toil, it bespeaks a state of society, where sobriety is habitual, and intelligence is held in estimation.

Whatever we may be disposed to think of the value of the knowledge which Sir F. H. Doyle here describes, for effecting the great end of all education, the intellectual and moral development of the individual, there cannot be a doubt that the mere circumstance of these northern peasants searching with such avidity for something which does not immediately minister to their material gratifications, plainly indicates a state of social advancement very far beyond what is to be found in the counties where ganging and apprenticeship prevail. We believe that it is to their better education that the superior condition of the peasants of the north is almost entirely to be attributed, and that there is no way in which we can so directly influence the condition of the people for good, as by increasing and improving the means of public instruction. In rural districts, especially, much may be done by the upper classes for the training of the people; and we are certain that in no other way can they so well testify their interest in their fate. By this means they will increase their industry, their frugality, their providence, and their self-respect, and will thus, at every step, raise up barriers against their ever falling into the slough of poverty and vice. But there is one other reason, and one not so frequently urged, in favour of improving the instruction of the agricultural labourer. He, more than the denizen of a town, is exposed to a species of mental torpor, the result of the monotony of his employment, and of the unvarying character of the scenes in which he moves. If permitted to increase, this deadening of the faculties, particularly in minds of no great original activity, often comes at last to be a species of disease. From want of mental exercise and excitement, the whole nervous system becomes relaxed, and hence we find a premature dotage taking hold of the hind between his 50th and 60th year. He becomes listless, stupid, and unimpressionable; life has ceased to have an interest for him, and he vegetates merely. The cure for this malady is suggested by considering the reverse of the picture, as it is seen in the condition of those of the upper classes, whose professions compel them to great and constant mental exertion. Statistics show that the members of the learned professions, notwithstanding the sedentary life which they are compelled to lead, are as long-lived as the rest of the community; and we know from many examples, that literary men, in particular, not unfrequently carry into extreme old age all the freshness and buoyancy of youth.

Education, by which the mind is stored with images, and impelled to exertion, is the only means by which we can assimilate

the condition of the lower classes, in this respect, to that of the higher. To the all-important subject of education, particularly as applied to the rural labourer, we shall probably have again to recur. Our present endeavour has been to show, that the condition of the peasant, even under existing circumstances, far from being hopelessly below that of the manufacturer, is the best which falls to the share of any one, whose fate it is to gain his bread by labour within these islands. If we have succeeded in this, we shall probably also have convinced our readers, that it is the duty of every one of us, strenuously and vigorously, to labour for the preservation and improvement of the agricultural labouring population, and not to sit down and listlessly fold our hands in the conviction that they must inevitably pass away before the march of manufactures, as the American Indians do before the inroads of civilisation, or as postboys insensibly melt before the ardent genius of railway stokers.

FARMER'S NOTE-BOOK.—No. XVII.

*Boussingault's Experiments in Feeding Cattle on Dry and Green Food.**—To find the cheapest and most effectual mode of feeding cattle, is, for the farmer, a problem of the highest importance; in fact, that question, although involving one only of the numerous branches of agricultural art, is in itself a science—a science, with its rules, its theories, its discussed principles, its progresses already made, its much progress still to make—a bold science, that attempts to sound those mysterious and powerful means by which grass, hay, and other vegetable matters, are transformed into milk, flesh, bones, blood;—and, above all, it is a useful science; the more so, considering the enormous increase of population that years of peace and civilisation have brought all over the world—an increase that threatens to render the supply from the soil inadequate to the wants of men, if the agriculturists do not make the utmost efforts to produce the greatest quantity of food in the smallest space.

In no country has that science been cultivated more, and with greater success, than in Great Britain; in no country have the farmers made more strenuous and skilful attempts on that subject—have more satisfactory results been obtained as regards the cattle, both in point of quantity and of quality. The agriculturist has tried to do the best with his land, to employ it in the most profitable manner, so as to be able on a few acres to feed many head of cattle where formerly one single animal would have starved; not only to feed them, but to feed them well; to fatten them, so that he may have a right to be proud of his herds, and to look upon them with a well-earned satisfaction. Improvements gradually brought in—the extended cultivation of more nutritive crops—the invention of new implements, have favoured these advances; and, no doubt, they will be in no way checked by the knowledge of this fact, that last year, in which important crops failed, and famine was threatened in the greater part of Europe, those countries suffered less in which cattle were most numerous, and in which the inhabitants were dependent for their subsistence more upon butcher meat than upon other articles of food. But if Great Britain is at the head of these improvements, she is by no means

* *Experimental Researches by Boussingault.* Translated from the French with Critical Remarks, by Mr William De La Rive, of Geneva, Assistant in the Laboratory of the Agricultural Chemistry Association of Scotland.

progressing alone. In other countries there are agriculturists, men of science and of practice, who are anxious not to remain too far behind. Both in France, and in Germany especially, there is many a name that deserves a place in the history of the most ancient of all arts; and laborious investigations are constantly made. In France, Monsieur Boussingault, who, to the possession of a good landed property, adds that of great science, and an ingenious and inquisitive mind, is at the head of that school, which starts from facts and experiments in order to arrive at other facts, and scarcely ventures on the sometimes dangerous and often treacherous, but tempting, sea of theory.

This school, more modest, is not the less useful on that account, we should rather say, it is the more so. Agriculture is a science that advances step by step; her conquests are perhaps slower, but more certain, however satisfactory to a great mind may sometimes be the application of principles that genius believes itself to have discovered. The farmer who wishes to succeed, requires to be prudent and cautious—prudent and cautious, with intelligence, and without prejudice—prudent and cautious, when thinking that so many conditions of time, of situation, of distance from the sea or from a railway, of weather, may, nay must, modify the rules of science; and that, after a failure, the only consolation is to know that his case is an exception, for this or that reason, and that it is exactly that exception which proves the truth of the rule.

The farmer, therefore, we repeat, must be prudent and cautious; but, unfortunately, it very often happens that he resists true science, and is caught by quackery. There are many who, having refused to follow the advices of practical agricultural chemistry, have dearly bought from A, B, and Co. a quintessence of manure, or a remedy for the potato disease. Quackery is so insinuating—looks so candid, so perfectly disinterested—working for the good of mankind—explaining so well her advantages and processes in one single page, producing so many testimonials of thanks and gratitude; whilst true science is to be found in large books, and not to be obtained without much labour and time. Away, says the farmer, with science; and he purchases the universal panacea; and he forcibly reminds us of the old story, in which a man dares not pass through a shallow torrent, because it is noisy and frothy, but confidently steps into a smooth peaceful river, and drowns himself.

But enough on this subject; let us return to Monsieur Boussingault.

This distinguished agriculturist is the author of some volumes; but he generally publishes discoveries, as soon as they

are made, in the French scientific journals; and as he does not make his discoveries by dozens at once, his articles are generally short and instructive. Of these we shall translate two, both on a subject very far from unimportant, viz.:—*The comparison of the nutritive powers of green and dried fodder.* These articles are of different dates; one was published in February last, but the other is already a year old.

This subject, we said, is important. Most agriculturists think that green is more nutritive than dry fodder. This is a general opinion, that seems to have been tested by time, and much more by the customs of some countries. In an article by Professor Johnston, published in the *Journal of Agriculture, and Transactions*, &c. it is stated, and the fact is given also in Mr Stephens's admirable work, that the peasants in Saxony, in order to keep their fodder green, put it into pits, mixing it with salt, and carefully covering the whole. Unless the fermentation that unavoidably ensues has the effect of transforming some of the substances contained in the grass into more nutritive matters, we can see no other advantage in that process, but that of keeping the fodder wet and green. Now, Monsieur Boussingault questions whether this is an advantage or not, and his experiments seem indeed to refute it. But let him speak for himself. We must, however, previously remark, that in converting the French weights into British, we have neglected the fractions of ounces and *grains*; Monsieur Boussingault having neglected the *grammes*, the weights being considerable, the omission is of no consequence.

I. Experimental researches on the feeding properties of green fodder.—It is generally admitted that fodders consumed when green are much more nourishing than when they are dried; in other words, it is believed that a hundred pounds of clover, lucern, or meadow grass, have a far greater nutritive value than the hay obtained from a hundred pounds of each of these elements. However, in carefully perusing what has been written on this subject, I have found nothing to justify that opinion. Indeed, two good observers, MM. Perrault and Jotemps, have ascertained that, to feed sheep, it will require 3 lbs. 3 oz. of hay, clover, or lucern, to replace 8 lbs. 13 oz. of the same fodder green; under the influence of either of these rations, there is a sufficiently satisfactory growth of wool and flesh. On the other hand, those agriculturists have practically ascertained that, in the winnowing, including the fermentation in the hay loft, and all the accidental losses, 100 lbs. of clover or lucern are reduced to 23 lbs. of hay. From these results we draw this conclusion, that in giving to a sheep 3 lbs. 3 oz. of dry lucern, we administer to him exactly, in point of value, the equivalent of 14 lbs. 6½ oz. of green; therefore,

5 lbs. $8\frac{1}{3}$ oz. of green food more than is required when the ration is composed of the undried plant; and if a hundred pounds of clover or lucern, newly mowed, are requisite to feed an animal, it will require, to feed it in the same degree, the hay obtained from 163 pounds of the same fodder.

It may easily be understood that this mode of proceeding is too indirect properly to resolve the question we have in view. The discussion presented by MM. Perrault and Jotemps merely proves what no one thinks of denying, viz.:—that the most advantageous way of using the produce of artificial meadows, is to have it consumed as much as possible whilst green, so as to avoid the expense, the loss, and all the casualties of hay-making. But this discussion does not in the least establish that the nutritive power of green fodder is diminished by the simple fact of its being dried; the physiological question is thus left untouched. For many years I have made various experiments to resolve it. For that purpose I paid the greatest attention to the changes in the weight of thirty-two horses, on which my researches were made, from the alternate substitutions of dry and green fodder. The results have been at one time in favour of, at another against, the green diet; and, after very numerous weighings, I found that I was as little advanced as when I first began my experiments.

These contradictory results can be explained by the imperfection of the method I had adopted. It is quite evident that the hay with which the horses were fed, having been obtained in the previous year, did not answer, as regards the quality, to that which would have been furnished by the green clover with which it was compared; and as for this last fodder, there was constantly a great uncertainty in the real weight of the ration given, in consequence of the greater or smaller proportion of water it contained. Some experiments which I have made on the drying of the clover, show, indeed, how much that proportion varies according to the age of the plant, the nature of the soil, and especially, according to the meteorological conditions during which the cutting had taken place. This may be illustrated by examples taken on second year clover:—

May 19th, First cutting before flowering—1000 lb. of hay gave	212 lb. of water.	
June 3d, First cutting in flower, .	do. do. 288	... ...
June 5th, (another district) First cutting in flower—	305	... ...
July 28th, Second cutting in flower,	do. do. 290	... ...
August, Second cutting—very much in flower—very woody, . . .	do. do. 360	... ...

We may add, that, during the drying, the clover experienced a considerable loss, from the leaves and flowers falling, and not

being picked up, during the making. The loss affects exactly the most substantial parts.

In order to guard against the causes of error I have just mentioned, and to obtain comparable results, I have conducted the experiment in such a manner, that the dry fodder consumed represents precisely the hay we should obtain from the same quantity of green; but as it is then necessary continually to make hay—an operation that becomes very tedious when performed on a considerable quantity of clover—I experimented on a single animal, a heifer about ten months old.

The heifer was weighed when fasting. She was given a ration of green fodder, a little smaller than that she ordinarily consumed, in order that the fodder should be entirely eaten during the twenty-four hours; then, at the very moment that the green ration was put into the manger, another, exactly the same in weight and quality, was selected, and immediately dried, taking every precaution to prevent the loss of the parts loosened during the drying. This dried ration was put into a bag marked No. 1. On the second day the same operation was repeated, keeping still for drying a quantity of fodder exactly equal to that to be eaten green; and that dry ration was put aside as No. 2; and so on.

The heifer was thus fed on green food during ten days; on the eleventh day, in the morning, she was weighed, and then was put on dry fodder. She received successively the hay kept in bags No. 1, No. 2, No. 3, &c., so that during the ten following days the heifer took exactly the same allowance and the same quantity of food she had received during the ten preceding days; the only difference between the two diets being that arising from the presence or the absence of water in the plants. At the end of the dry feeding the animal was weighed. It may be, therefore, seen that the whole experiment lasted twenty days:—

FIRST SERIES.

Days of observation.	Green Clover consumed			Days of observation.	Nos. of the Forage.	Dried Clover consumed.	
	lbs.	oz.				lb.	oz.
1st day	71	12	The heifer weighed 5 cwt. 36lbs. 4oz.	11th day	1	16	0
2d day	60	11		12th day	2	15	1
3d day	44	3		13th day	3	16	5
4th day	55	3		14th day	4	21	11
5th day	53	0		15th day	5	17	8
6th day	49	11		16th day	6	16	7
7th day	44	3		17th day	7	16	10
8th day	44	3		18th day	8	16	10
9th day	49	11		19th day	9	14	1
10th day	48	9		20th day	10	13	15
During ten days - -	521	2		During ten days -		164	4

On the eleventh day, when fasting, the Heifer weighed 5 cwt. 29 lbs. 10 oz.
On the twenty-first day, when fasting, the Heifer weighed 5 cwt. 40 lbs. 8 oz.

SECOND SERIES.—In the interval between the first and the second series, the heifer was fed without restriction.

Days of observation.	Green Clover consumed.			Days of observation.	Nos. of the Forage.	Dried Clover consumed.	
	lbs.	oz.				lbs.	oz.
1st day	49	11	The heifer weighed 6 cwt. 3 lbs. 12 oz.	11th day	1	13	3
2d day	55	3		12th day	2	13	0
3d day	60	11		13th day	3	14	14
4th day	57	7		14th day	4	14	4
5th day	55	3		15th day	5	19	8
6th day	55	3		16th day	6	17	7
7th day	53	0		17th day	7	15	12
8th day	66	4		18th day	8	18	13
9th day	60	11		19th day	9	19	3
10th day	55	3		20th day	10	19	0
During ten days - -	568	8		During ten days - -	- -	164	11

On the eleventh day, fasting, the heifer weighed 5 cwt. 104 lbs. 11 oz.
On the twenty-first day, fasting, the heifer weighed 6 cwt. 8lbs. 3 oz.

THIRD SERIES.—Fed on after-math.

Days of Observation.	After-math consumed.			Days of Observation.		Dried after-math consumed.	
	lbs.	oz.	The heifer weighed 6 cwt. 54 lbs. 9 oz.			lbs.	oz.
1st day	90	9		11th day	1	13	3
2d day	90	9		12th day	2	13	0
3d day	88	5		13th day	3	14	14
4th day	88	5		14th day	4	14	5
5th day	90	9		15th day	5	19	3
6th day	92	12		16th day	6	17	7
7th day	94	15		17th day	7	15	12
8th day	91	10		18th day	8	18	13
9th day	92	12		19th day	9	19	3
10th day	93	13		20th day	10	19	0
During ten days - -	914	3		During ten Days - -	- - -	164	12

On the eleventh day, fasting, the heifer weighed 6 cwt. 63 lbs. 6 oz.
On the twenty-first day, fasting, the heifer weighed 6 cwt. 86 lbs. 9 oz.

RESULTS OF THE OBSERVATIONS.

FIRST SERIES.

	cwt.	lbs.	oz.
Original weight of the heifer, - - -	5	36	4
After the grass diet, - - - -	5	29	10
Loss occasioned by the green diet, - - -	0	6	10
After the diet of the same fodder, dry, - -	5	40	8
Gain, occasioned by the dry diet, - - -	0	10	14

SECOND SERIES.

	cwt.	lbs.	oz.
Original weight of the heifer, - - -	6	3	12
After the green diet, - - - -	5	104	11
Loss occasioned by the green diet, - - -	0	11	1
After the diet of the same fodder, dry, - -	6	8	3
Gain occasioned by the dry diet, - - -	0	15	8

THIRD SERIES.

	cwt.	lbs.	oz.
Original weight of the heifer, - - -	6	54	9
After the green diet, - - - -	6	63	6
Gain occasioned by the green diet, - - -	0	8	13
After the diet of the same fodder, dry, - -	6	86	9
Gain occasioned by the dry diet, - - -	0	23	3

Before coming to a conclusion, it was necessary to know what was the extent of the accidental variations in the weight of the animal experimented upon. Numerous successive weighings

made each day, at the same hour, have shown that the greatest difference amounted to 13 lbs. 4 oz. Therefore a difference of that amount could not with certainty be attributed to the influence of feeding, since it is within the limit of the accidental variations of weight.

It may be remarked, that the ascertained gains, in consequence of the substitution of the dry for the green rations, have been 10 lbs. 14 oz., 15 lbs. 8 oz., 23 lbs. 3 oz.—results that might allow us to presume that the same quantity of fodder when dry is more nutritive; but from so few experiments it would be premature to draw such a conclusion. What these experiments seem to establish with some certainty is, that a given weight of dry fodder is not less profitable for feeding than the quantity of green fodder which it is derived from.

We will next give a short article relating to a subject very similar to the one treated in the previous paper, viz.:—*Upon the difference in the nutritive properties of green and dried fodder.* This seems to be a consequence of the one we have just given above; but the results, as will be seen, appear not to agree. However, we must not anticipate; and let our readers judge for themselves:—

2. *Of the use of steeped fodder in the feeding of cattle.*—Some breeders are in the habit of steeping the dry forage for cattle, in the belief that hay and clover acquire, by being thus soaked, more powerful nutritive properties. The amount of water absorbed in that operation is such, that 25 lbs. of dry clover will, after a twelve hours' infusion, be 100 lbs. in weight. It seems that by being steeped, dry fodder returns in some manner to its former green condition.

It might be presumed that, during the late hot and dry summer, moist food would be more profitable to the cattle than the hay given them, in consequence of the scarcity of herbage—the second cutting of clover having pretty generally failed.

Upon that consideration, I determined on making a comparative trial, in order to ascertain the effect of steeped fodder. The details of the following experiment I remitted to Monsieur Eugene Opermann, who is training himself in Bechelbronn to the practice of agriculture.

Four heifers, from seventeen to nineteen months old, were divided into two lots; one of the lots, No. 1, consumed hay and dry clover; No. 2 received the same quantity and the same kind of fodder previously steeped during twelve hours. Each lot was daily fed in the proportion of three pounds of hay for each hundred pounds of living weight. The following is the result of the first experiment, that lasted fourteen days:—

Initial weight of the heifers.	Weight after fourteen days of that diet.		Total gain.		Daily gain		Fodder consumed.	
	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
Lot No. 1, 1594 lbs. 7 oz. (on steeped fodder.)	1645	3	50	13	3	$3\frac{3}{4}$	668	$8\frac{3}{4}$
Lot No. 2, 1704 lbs. 13 oz. (on dried fodder).	1749	0	44	$2\frac{3}{4}$	3	$2\frac{1}{2}$	689	0

This experiment was repeated inversely, so that the steeped food was consumed by the cattle that had hitherto received dry fodder. The result obtained did not differ much from the last; for—

	lbs.	oz.
The lot No. 1, receiving the dry food, gained in fourteen days, ...	50	13
The lot No. 2, receiving the steeped food, gained in fourteen days, ...	48	9

The difference that seems to result in favour of the steeped hay is so slight, that it may very easily arise from an error in the observation; but this difference, were it real, would not pay the working and annoyance attending the operation of steeping.

During his researches, Monsieur Opermann has ascertained that the cattle eat steeped fodder more rapidly. It so happened, that one lot consumed a steeped ration in forty-five minutes, whilst another lot required one hour to consume the dry ration.

A greater rapidity in the consumption may sometimes be advantageous; for instance, in fattening, when the quicker the food is swallowed the better. No doubt besides, steeped fodder, being more easily masticated, is proper for very young stock when they pass from milk to vegetable food. In a word, dry food, after having absorbed two or three times its weight of water, must present the advantages that occur in green forage, which, if not more nourishing than the hay it produces, is at least consumed with greater avidity. Hence it results that green feeding is generally more profitable; and this probably would also be the case with steeped fodder if given in the same quantity, and under the same conditions.

Being anxious to know the influence that steeped hay would have on the production of milk, I engaged Monsieur Opermann to estimate the return of milk from two cows, to each of which were daily given three pounds of dry forage for every hundred pounds of living weight. To the one steeped food was given, to the other ordinary hay. After a fortnight of the two diets, no difference whatever was to be perceived in the production of milk.

The way in which M. Boussingault has proceeded in these two sets of experiments, is really a good one, and such as is likely to throw light on the difficult question regarding the relative nutritive properties of various kinds of food. The advantage of these experiments is, that they are simply conducted—are such as any intelligent agriculturist has it in his power to make—and are clearly described.

However, there is in the whole course of these observations one defect, that cannot but immediately strike any person on reading them, even with the slightest degree of attention. The defect is, that the experiments do not last long enough. It is a well known fact that a diet, to exercise some influence, must be continued during a certain length of time. Now, what does M. Boussingault? He gives the diet for only ten days, or at most fourteen. In the first article, we have ten days green food, ten days dry. The heifer is weighed, and we come at once to our conclusions. In the second we have fourteen days; an improvement upon the first, but it is not yet enough. Ten days, and even fourteen days, are much too short a time to allow us to come to any positive results in matters such as these. Lord Spencer, wishing to ascertain the comparative feeding properties of mangold wurzel and Swedish turnips (*Journal of the Royal Agric. Soc. of England*, 1841, Part III. p. 296), proceeded in the same experimental way M. Boussingault had followed. He took two steers, equally well bred, weighing the same; one was fed with Swedish turnips, the other with mangold wurzel. But did Lord Spencer stop after ten days experiment, or even after fourteen days? No; during a whole month he fed one of the steers with Swedish turnips, and the other with mangold wurzel; he then weighed and repeated inversely the experiment, till he was satisfied that the mangold wurzel was more nutritive than the Swedish turnips. We only give this as an instance of what can and must be done in agricultural experiments. "Time and patience—patience and time," ought to be the motto of every one who wishes to make good observations. These may be tedious, may be long, but how much more certain, how much greater credit their author deserves!

We therefore regret that M. Boussingault did not pursue his experiments during a longer time; the more so, that the kinds of food that succeeded immediately one to another, were on one hand green food, on the other dry fodder; and nothing, it is well known, relaxes more the bowels of an animal at first, than being put on green food; and it is only after having been for some time accustomed to that kind of aliment, that cattle begin to profit and fatten upon it. There is first a loss, and afterwards comes the gain. In ten days the heifer had just time enough to

experience the loss, not enough to gain. In the three series of experiments, the heifer was less heavy on the eleventh than on the first day; and no wonder, for the sudden change from one kind of food to the other would impair the condition of the animal, so as considerably to endanger the accuracy of the observations; and in this case, indeed, it must be confessed that there is strong proof of every thing not being right, when the animals were reduced by a diet which is known to fatten oxen, and to procure abundant milk from cows.

We did not at first very well understand what M. Boussingault meant by *accidental variations in weight;* probably the loss or gain occasioned by exterior circumstances, independent of food; for instance, some disease or accident, or any thing we cannot ascribe to the kind of diet. When we consider that these accidental variations were as great as most of the normal variations, and more than any of the losses occasioned by the green diet, we cannot help thinking that their cause may have been that very same green diet. Probably, at the beginning, the new diet acted vigorously, and a loss was experienced; then its benefits began to be felt near the end of the experiment; but the eleventh day comes, the weighing is made, and the result might be without a great mistake put amongst the accidental weights.

The defect in the duration of the experiments prevents us from relying with entire confidence on M. Boussingault's results; and this we regret, because his manner of observing and of making experiments is as good and practical as can be; besides, we think, in looking over the numbers of the weights of daily food, in the first article, the daily food perhaps was a little too scanty; and although we perfectly understand M. Boussingault's motive to have been in this case to secure the eating of the whole he gave, and consequently a greater accuracy in his results, we fear that circumstance may have impaired, slightly perhaps, but nevertheless impaired, the health of the animal, and therefore rendered the observations in some degree uncertain.

In the second article, the results are really very insignificant; lot No. 1 receives steeped fodder, and gains 50 lbs. 13 oz. in fourteen days; lot No. 2 receives dry fodder, and gains 48 lbs. 9 oz. in fourteen days. We have said the results were insignificant; we should have said, on the contrary, they prove a great deal; and we are forced to admit, together with M. Boussingault, that there is no advantage in the steeping of fodder, although we should have expected that it would not fail to increase the quantity of milk produced by the cow.

Altogether, the question treated by M. Boussingault is one of high practical interest, and therefore worthy of consideration;

the more so, that his results seem to be opposed to the opinion of those names which are held as authorities in agricultural matters. It seems to be generally understood, tested by experience, and hitherto held as certain, that green is more nutritive than dry food. M. Boussingault infers the contrary; although we must here say that we cannot pass without noticing a phrase in his article on steeped fodder, in which, contrary to his conclusions in the previous one, he says, *that green feeding is generally more profitable.* No principle can be yet deduced, the experiments carefully conducted not yet being numerous enough; but numerous and well conducted we hope they will soon be, and we doubt not but that such an important problem will not be left long undecided. Some agriculturist will repeat the experiments made by the French chemist, on the same sound practical principle, but with such improvements as are calculated to make them certain and conclusive, and with that care which alone can ensure a truly valuable result.

We trust, therefore, that before long we shall know which is the most nutritive—dry or green food; the observers not forgetting that if they wish to deserve confidence, they must repeat their observations, provide for every event, and be as sharp and penetrating and rigorous as an advocate in cross-examining a witness in the box, and finally extracting the truth out of his reluctant mouth. Nature tells her secrets only to those who seek them with an ardent mind, and a true spirit of accuracy and research.

The Amenity of Rural Scenery as affected by Lines of Railway. By Mr David Gorrie, Annat Cottage, Errol.—In the ancient or geometrical style of gardening, which prevailed at a time when the general face of the country was waste and uncultivated, orderly and symmetrical effect was chiefly sought after, as a means of producing that pleasing contrast which heightens in degree every kind of beauty. The straight gravel walks in the gardens of ancient monasteries, contrasted pleasingly with the rugged footpaths that led across the neighbouring wilderness; the embroidered flower-beds appeared beautiful and attractive in the sight of those who were accustomed to look upon wild entangled brakes and waste morasses; and the conspicuous and neatly kept fences were associated with ideas of comfort and security in the minds of persons living in an age when moral protection could not be ensured to any, and when all had to depend on physical means of defence. The causes that led to the adoption of geometrical gardening were thus natural to the human mind. In our own more civilised times,

this style of gardening may be practised, in the absence of these causes, from that innate love of symmetry and exactness which is found in every mind, and manifests itself at an early stage of life in the case of children, who attempt to arrange their playthings in an orderly manner, whenever they become able to handle them; and account a piece of printed cotton, bedaubed with spots at regular distances, as possessing more beauty than the most highly finished painting of a picturesque landscape. The feelings of an antiquary may, moreover, impel him to imitate the clipped evergreen hedges, and straight or geometrically curved lines of an ancient garden, as thereby associations of ideas connected with the remote past are raised in his mind. When bounded by narrow limits, such as the rectangular fences that enclose a suburban garden, an improver finds himself compelled to resort to the ancient style; knowing, that if he were to form serpentine walks, and plant picturesque masses of trees in such a situation, the effect would be, an assemblage of forms incongruous and absurd.

The feelings that prompted the first designers of gardens in the modern style were equally natural, and equally dependent on circumstances, with those that gave rise to the style that prevailed in ancient times. When the country began to manifest a commercial and agricultural character—when fields, bounded by straight fences, began to diversify its surface—and when smooth and broad roads were formed where bridle-roads or footpaths formerly existed—an innate love of contrast and variety gave rise to a style of laying out gardens and pleasure-grounds, in which straight walks, formal rows of trees, and conspicuous fences, found no place, or were accounted as deformities. On the first introduction of this style, landscape improvers ran to an extreme, exactly opposite to that where those of ancient times arrived. They acted as if no beauty existed in any form that was not made up of curved and sweeping lines. They made their walks regularly serpentine, placed their mansions in the midst of smooth grass fields, over which round or oval groups of trees were scattered at regular distances:—

> To improve, adorn, and polish, they profess'd,
> But shaved the goddess whom they should have dress'd.

The ancient architectural terraces and walls were banished, and a formal belt of trees served to hide the boundary fence, so disagreeable in their eyes. In the estimation of true taste, this perversion of the natural style was more displeasing than that geometrical mode of laying out grounds which, at the time, was so much spoken against.

The lovers of picturesque scenery could not remain long silent while this was going on, and they published several volumes

explanatory of the true natural style. Much has been said and written by the disciples of those different schools whereinto modern landscape gardeners have classed themselves, in furtherance of their own views; and, perhaps, a satisfactory conclusion to the subject would have been sooner arrived at, had it not been for an erroneous opinion that was, and still is, widely entertained, to the effect that landscape gardening cannot be classed amongst the arts and sciences, and that its practice must ever be dependent on individual taste. This error cannot be too loudly testified against. It is founded on a perversion of the word *taste*, which many confound with *fancy*, a totally separate idea; and it may cease to be so prevalent on the arrival of that day, when no person professing the art will venture to recommend any alteration in scenery, for which he cannot give a satisfactory reason, drawn from a knowledge of the nature of those inherent faculties, which render the soul of man capable of appreciating true beauty of form and harmony of arrangement.

The grand characteristic of picturesque park scenery is quietness and repose, or what may be termed the passive sublime. The changeless green of the smooth grass tends to the production of this expression; an expression that is in vain sought for in scenery where the ground bears the marks of having been disturbed by the spade or the plough. Trees form a principal ingredient in park scenery—and more especially native old trees, as distinguished from young species of foreign origin, protected by artificial means, such as wooden or iron railings. The waving motion of branches and trembling of leaves, add to the character of sublimity possessed by aged trees, and detract not from that quiet repose which the presence of moving objects of an artificial kind is sure to destroy. The feelings, associated with the presence of trees that have for ages withstood the raging of the tempest, are of a highly conservative nature, and are fitted to excite veneration for long established laws and usages. The presence of cattle or sheep is favourable to an expression of repose, whether they be in a moving state, or resting under the shade of trees. They also impart a cheerful appearance to the landscape; and, lacking their presence, an otherwise beautiful scene is liable to partake of dulness. Immovable artificial objects, such as houses and bridges, are admissible in quiet rural scenery, inasmuch as they interfere not with an expression of repose. But clear and still, or smooth-flowing water, is the centre which unites such scenery in one grand whole. The effects of clear, smooth-flowing water, in a landscape, are thus described by Homer:—

> And where Pieria, roll'd through banks of flowers,
> Reflects her bordering palaces and bowers.

The associations connected with still water are familiar to the mind of every one, and have been thus beautifully clothed in language by Scotia's ancient bard, in portraying the countenance of a mighty chief who had been slain in battle:—"When thou didst return from the war," says Ossian, in lamenting the death of Morar, "how peaceful was thy brow! Thy face was as the sun after rain; like the moon in the silence of night; calm as the breast of the lake when the loud wind is laid."

From such considerations as these, it may appear that the congruity of garden scenery, laid out in the natural style, and, by consequence, the quiet scenery of nature herself, must be impaired by the presence of a conspicuous line of railway, the ideas associated with which relate to man, considered as a being devoted to the active pursuits and business of life. Moving artificial objects of any kind are destructive of the passive sublime; and an expression of quietness and repose cannot be maintained in a landscape, where even a solitary windmill rears its restless arms in the distant horizon.

Congruity, or, as it has been defined, "a proper adaptation of the several parts to the whole, and that whole to the character, situation, and circumstances of the place and its possessor," has been mentioned as liable to suffer from the intrusion of railways into quiet rural scenery. Other principles of the landscape improver's art may be noticed, as also liable to receive injury. Continuity, or an appearance of boundlessness and absence of restraint, is destroyed, when ground is visibly cut up, or when the natural shape of the ground is altered by railway operations. Order, including correctness and finishing; association; grandeur; simplicity; picturesque effect; and other principles that might be mentioned—cannot be successfully carried into practice in scenery thus broken in upon.

Various means may be used in certain cases for concealing a railway line in such situations, where its appearance is obtrusive. By planting trees, a screen may be formed to prevent it from being seen; and by forming the ground on both sides of a cut after a certain fashion, the eye of a stranger might be carried over the line, while its existence, save when a train was passing, would remain unknown to him.

As a general rule, however, it is safest to adhere strictly to the geometrical style in adorning grounds in the close vicinity of railways, and thus to render such measures of concealment wholly unnecessary. A railway is in itself an artificial object, and any means used to ornament its sides ought to exhibit art and design in a bold and fearless manner. It were better to forego those beauties which belong to the natural style, than to have them irretrievably injured by bringing them into close contact with such

artificial objects as communicate ideas of restlessness, activity and change. Picturesque masses of trees appear incongruous when bordering on a rectangular field or a straight line of turnpike road, and far more so when shading the verges of a railway.

In attempting to confer appropriate ornament to a line of railway, the first objects to be attended to are those cuttings and embankments that may have been executed in course of its construction. Where cuttings have been made in solid rock, it is best to leave the rocky banks steep and abrupt, instead of sloping them down and covering them with turf. Where earth has been out through, the banks should be correctly sloped at an angle of thirty-five degrees, and may be planted with spiral-shaped trees, the vertical forms of which will contrast effectively with the long and otherwise tiresome lines of rails and fences. Embankments ought to be sloped with all the exactness employed in forming a terrace-walk in a garden. It is best not to plant trees on the sides of embankments, as they will look depressed and mean when the lower parts of their stems are hidden; and a row of spiral trees along the line of fence will be sufficient for producing the amenity of contrast between vertical and horizontal lines. The fences come next in order, and when hedges are employed, they should be closely and architecturally clipped, and may be formed of spruce-fir, which, from its close evergreen appearance, is far more beautiful in a line of hedge than hawthorn, while it may be rendered a durable and efficient fence. Trees planted along the sides of railways appear most in character, as has already been hinted, when their shape is spiral or fastigiate. The Lombardy poplar is a suitable tree in level situations; and the cypress, upright evergreen oak, and various kinds of cone-bearing trees, are well fitted for the sides of cuttings and embankments. In an agricultural country it is an easy matter to harmonise lines of railway thus ornamented with the straight sides of fields and hedge-rows which appear in the same field of vision; but in the vicinity of park scenery it requires some care to produce a gradual and imperceptible union between the artificial style along the sides of railways, and the more natural scenery at a distance. The two styles require to be melted into one another in such a way as the point of union may be undistinguishable. In the vicinity of large towns, the preservation of a strictly artificial appearance in the ornamental accompaniments of a railway, is of special importance.

Wherever railways are formed amidst garden scenery, a new field of action is opened up before the landscape gardener, and he at least is afforded the opportunity of making the best out of a case that at first appears to be a bad one. Where they ruthlessly [illegible] and scenery of nature,

the lover of natural scenery must rest content with being allowed the liberty of entertaining feelings of regret.

The main argument for enforcing attention to such seemingly unimportant considerations as the above—unimportant in the estimation of a cold, calculating age like the present—rests on the fact, that a taste for the beauties of garden scenery is of high value when found existing in the minds of those individuals who, in a collective capacity, constitute a nation. The innate and immortal faculties of man, which may be largely gratified in a future state of existence, and which, even in this life, render him capable of receiving pleasure in the contemplation of beautiful objects, repay their cultivation by tending to the production of a refinement in manners, both in the case of nations and individuals. It is universally admitted that a love for flowers, or for other objects of natural beauty, indicates a degree of refinement in that bosom where it predominates and is cherished; and the authentic pages of history inform us, that in all ages a national taste for gardening, architecture, and the fine arts, has been a sure sign that civilisation was gaining the ascendant over former barbarism. It becomes, then, a national object to foster and provide for the gratification of feelings of desire after the pleasures afforded to the mind by those two great principles of landscape gardening—beauty and harmony.

Hedge-Rows; or, Beauty and Utility in Union. By Mr DAVID GORRIE, Annat Cottage, Errol.—Do hedge-rows really add to the beauty of a country? Before adverting to the views of such as entertain the affirmative, it may be well to state briefly the main objections to the hedge-row system which have been advanced by practical writers on agriculture.

The first and most momentous of these, relates to the quantity of good soil, fit for bearing corn, which they cover; not to speak of those ridges alongside of them, which are rendered unfruitful by the proximity of spreading-rooted and broad-headed trees. Mr J. Grant, in the Journal of the Royal Agricultural Society of England, gives some valuable statistical information on this point. He states as the result of an examination of ten parishes in Devonshire, that these parishes contain 36,976 acres of soil, and 1651 miles of hedge-rows; "about half as long again as the great wall of China, and sufficient to extend round the whole of England." In these ten parishes we are informed that the fields are of a small size, varying from one to ten acres; and that, by the kind of hedge-rows generally used, the loss of land is enormous; on those fields averaging three quarters of an acre, the loss is 17 per cent of the whole estate; on those averaging between one and two acres, it is 12 per cent; on those between

[illegible] Never was there a time when the prosperity of the British empire more depended on agriculture than at present; and never was there a time when the admonition of the poet was more attentively listened to—

[illegible] venerate the plough.

Hedge-row trees are hurtful to any fence wherein they may form an accompaniment, lessening its durability and efficiency, whatever be the kind of materials whereof it is formed. If composed of tall [illegible] trees, such as the ash, hedge-rows deprive the soil on either side of them of part of that nutriment which belongs of right to plants under the more immediate care of the farmer. They prevent the free access of the sun's rays to a portion of the soil near them, more especially when they run in a line parallel, or nearly so, to the equator—a circumstance of no little moment under our cloudy sky, though of less consequence in some sunny parts of the Continent, nearly in the same latitude with Britain, where corn will thrive close up to the very stems of trees. They are unfavourable to a free and wholesome circulation of air, and harbour destructive vermin of different kinds. They form one of the greatest obstacles in the way of the thorough-drainer, and retard the operations of the plough. Roads, highways, and lanes, suffer greatly from their shade;

and are, under its influence, rendered more difficult to keep in repair.

It must be stated, that, in certain situations, hedge-rows are not liable to all these objections. Where the diagonal line of a field runs north and south, the sun may shine at some time of the day on either side of the various enclosing rows of trees. In some cases, moreover, beneficial shelter may be afforded by such trees, and the masses of underwood which may accompany them. Many persons who condemn the system when practised in corn-growing districts, have no objection to see it sparingly introduced in a grazing country; though it is far better to scatter trees, in irregular groups and masses, on grass lands unsubjected at any time to the plough, or very seldom brought under tillage, so as to combine shelter and utility with scenic beauty.

The defenders of hedge-rows do not lack arguments in support of their own views, though they be chiefly of a sentimental cast. They say, indeed, that the evil which the system entails on the soil, and consequently on the nation, has been much exaggerated by writers on the other side, "especially if a proper selection of trees be made." They even throw the shield of protection over the baneful ash, on the ground that ash trees grown in hedge-rows form the best timber for the construction of agricultural implements, and for various other objects. This is no doubt true to a certain extent; but if it were asked why ash timber grown in woodlands is so unsuitable for such purposes, the careless and unscientific forester who allows his trees to be drawn up closely, instead of allowing the air and light to surround them freely on all sides by means of a regular and effective system of thinning and pruning, should be left to answer the question. The same may be said with regard to oak timber intended for naval purposes; and may also serve to confute an argument founded on the "narrow basis of individual utility," to the effect that "it is not useless to consider how many families and estates have been preserved, when pressed with temporal difficulties from which none are exempted, by a fall of hedge-row timber."

But "the enjoyment arising from the rich and beautiful effect produced by such decoration and ornament," as hedge-rows are said to confer on rural scenery, seems to be the main object of those who defend the system. They speak in glowing terms respecting the beauty of their varied outlines, and the attractiveness of those sweet shrubs and flowers which they cherish—the richness of the hawthorn's blossom, the elegance of the virgin's-bower, and the loveliness of the bank of violets. Similar language might be used regarding the beauty of our muirland wastes and purple heaths, but would be impatiently listened to, if national necessity called for the subjection of

the improvable parts of such grounds to the plough. It is not meant here to speak of the beauties of nature as objects unworthy of a nation's regard, or as if it were of little moment that those mental faculties which are fitted to imbibe delight and pleasure in the contemplation of beautiful forms and colours in the material world, should be gratified. Whoever looks upon man as a being whose existence ends not with his life, and who possesses certain faculties, susceptible even now of culture, which may yet expatiate amidst the beauty and loveliness of a better land, will unite in admitting that the culture of these faculties is a matter both commendable and important. And no one will deny that in countries where the love of flowers and other objects of natural beauty is prevalent, the general tone of feeling amongst the inhabitants is relatively of a refined and exalted cast, and opposed to debasing influences. It were indeed desirable that the various districts of our land did prominently exhibit gems of scenic beauty and attractiveness fitted to excite to the cultivation of those immortal faculties to which allusion has been made. But were such beauty to depend on the existence of hedge-rows, it were to be lamented that the physical necessities of a populous nation demand that it should be held in abeyance, and that beauty should be discarded because found to be inconsistent with utility—that first object of man, considered as a being dependent on the soil which he treads, for that food and clothing without which he cannot subsist. But we are desirous of showing that it is possible, in this instance, to harmonise utility and beauty, and thus to produce a unity of feeling and object between the farmer and rural economist on the one hand, and the poet and landscape-gardener on the other. The question may here be disposed of in a few sentences, though it involves principles that might elsewhere be enlarged to the extent of a volume.

With all deference to the opinions and feelings of many writers on rural scenery, it is submitted, that the beauty of a district intersected by innumerable rows of trees and shrubs, separating it into small and nearly equal-sized portions, is of a false and unsatisfactory character. A level country thus divided, and looked down upon from a neighbouring hill, or a distant brae-side intersected by such lines, and observed from the level ground or the opposite side of a valley, would not be chosen by a *real* landscape-painter as a field whereon to exercise his pencil or brush. Such a scene is frittered away into an assemblage of minute parts past enumerating, and there is no leading object, no extensive piece of ground clear of trees, or on which trees predominate, to serve as an apex to the pyramid, a centre of attraction concentrating ... the other parts of the picture around it. At first sight all ap-

pears to be variety, forming a perfect maze of beauty; but very soon it is discovered that there is an insufferable sameness amongst the different parts. The eye can rest on no particular spot, and wanders hurriedly over the landscape, which thus appears less extensive than it really is. One half of the scene just reflects the other. Field after field and row after row succeed each other, till in the distance all are blended in a confused mass of mixed colours, in the contemplation of which the mind is exhausted or becomes a void, because, from the absence of a leading object in the landscape, it has failed in realising one grand leading idea. How tame and formal would the starry heavens appear, were the heavenly bodies of equal glory, and placed to our view at equal distances over the wide expanse of the firmament, instead of being scattered in wild profusion, with the glorious milky-way for the apex, the keystone, the concentrating object! A starry sky of the supposed kind might delight a little child whose first ideas of beauty are largely realised by the regular array of spots on its new frock, or on a carpeted floor, but would cease to please the same person when grown up and become possessed of a mind capable of appreciating natural beauty and grandeur.

Looking at the subject in this light, it is evident that the arable plains and brae-sides that are at the foundation of our national wealth and prosperity, might be rendered more beautiful than many of them are at present, were hedge-rows to give place to wide and uninterrupted expanses of corn lands, alternating with picturesque masses of trees occupying the higher and poorer parts of the soil, and united or mingled with the arable grounds by means of lesser groups, and even single trees, scattered along their borders in order to prevent the transition from field to woodland, from light to shade, from being too abrupt. By such means the waste of ground and all the other evils caused by hedge-rows might be avoided; trees might be raised in abundance on such soils as are not fit to be brought under the plough; and instead of looking on a scene broken down into innumerable and inharmonious portions, the landscape artist might be gratified in beholding much real beauty even in agricultural scenery. The traveller by the level road or railway, moreover, would no longer complain of having his view confined to a single field at a time, set in a border of trees and shrubs like a picture in a frame, and each such picture framed and mounted in the same manner as its neighbours. It might be stated among other things, that the fence of a geometrical corn field should be straight and architectural, whether it be a wall or a hedge; and that the wavy sky-line of a hedge-row, when viewed from the level ground in its vicinity, is out of harmony with this principle. But enough has been said, without trespassing further on the province of the

landscape-gardener, to show that in the adornment of rural scenery hedge-rows are not essential, and that beauty and utility may exist in unison.

Rabies, or Canine Madness. By James H. Fennell, author of "A Natural History of Quadrupeds."—Hydrophobia, a term expressing *fear of water*, is a complete misnomer when applied to this malady in the dog; for when the animal is afflicted with rabies, it drinks water not only willingly, but greedily, to the very last; but the term is perfectly appropriate when applied to the disease in man.

The Canicular or dog days, which are commonly supposed to begin on the third of July and to end on the eleventh of August, are so called, not from dogs being more apt to run mad during that interval, but from the heliacal rising of Canicula, or the dog-star, as typical of the season of greatest heat, or wane of the summer. Some ancient authors assure us that on the day this star first rises in the morning, the sea boils, wine turns sour, dogs begin to go mad, the bile increases and irritates, all animals become languid, and mankind are visited by dysenteries, burning fevers, and frenzies. The Romans, supposing Canicula to be the occasion of this period of sultry weather, offered up an annual sacrifice of a brown dog, at its rising, to appease its rage. It seems to be a vulgar error that dogs are more liable to become mad in warm than in cold weather; for in hot countries the rabies is indeed almost unknown, and our newspapers record as many cases in winter as in summer. On the Continent, where the disease is often caused by the bite of wolves, it seems to occur oftener in winter than in summer.

Hydrophobia has been chiefly observed in Europe. It has, however, never been described as occurring beyond the Arctic Circle; and indeed, according to some authors, it is seldom if ever heard of at Archangel, Tobolsk, or in the country north of St Petersburgh. Lisbon swarms with dogs, which prowl about by night and day without any owner, and yet it is said that no cases of hydrophobia are ever heard of there, notwithstanding the fact that the thermometer is sometimes at 110 degrees Fahrenheit. To appease the thirst of these animals, a certain number of tradesmen place vessels of water at their shop doors. The disease has never been observed at Constantinople, which city swarms with dogs; and it is stated to be rare also in the northern parts of Turkey, and more so in the southern provinces. In the warmest regions of America it rarely occurs, but is common in the northern part of that continent. Hillary saw some cases of the disease at Barbadoes. It is, however, extremely rare in the West Indies; in many of the islands it seems never to have been noticed. John

Hunter says that in the hot island of Jamaica, where dogs are exceedingly numerous, not one was known to go mad during forty years. The disease did not occur there formerly, but now it does. It occurs in India, but not often. Count Jacopo Graberg di Hemso, in his work on Morocco, states that dogs never have rabies in Northern Africa, nor in any Mahommedan country. At Aleppo and other parts of Syria, where great numbers of dogs perish for want of food and water, and the heat of the climate, this disorder is unknown. Though they abound in Egypt, and often suffer from hunger and thirst in that region, which is subject to a burning climate, yet, as Clot Bey assures us, no one instance of hydrophobia, either among men or animals, has been known there. The Egyptian dogs, which are somewhat fox-like, are during the day-time almost constantly in the shade, near basins which are daily filled with fresh water by the inhabitants. These dogs only run about in the night time, when they seek for carrion and offal. In disposition they are meek and peaceable, seldom fighting even among themselves. They manifest but once a-year a desire for sexual intercourse. Possibly this regularity in their desires, and their being at liberty to gratify them, renders them exempt from rabies; for there is reason for suspecting that the primary cause of this disease is connected with the sexual passion. It is well known that when under the restraint of captivity, the elephant, camel, and some other quadrupeds, have a periodical state of madness. In fact, camels, during their rutting season, are subject to a species of hydrophobia, crying incessantly, foaming at the mouth, and appearing to have a horror of water, which at this time they do not drink; they follow animals to bite them, and their bite is then extremely dangerous. They become thin, their hair falls off, and after some days of suffering, they die in convulsions. The drivers, in order to protect themselves, muzzle their camels at this season, and watch them with care.

A precaution commonly adopted in Paris consists in fastening over the noses of the dogs slight baskets, like muzzles, which are easily fixed on; and while they do not incommode the animal, nor prevent it from eating and drinking, they preclude it from biting. Dogs running about without this safeguard are very properly destroyed by the police. In a small town on the western frontier of France, during the hot days of 1824, placards were posted up to announce that poisoned sausages would be thrown to all dogs found straying. A gentleman who kept a pack of hounds, finding, notwithstanding great precaution, that his dogs frequently contracted rabies, at length succeeded in completely excluding it from his kennel, by making every new dog he admitted previously perform quarantine.

What is termed the *worm* underneath the dog's tongue, is a

muscle which assists the movement of that important organ. From a belief that the absence of the worm prevents the dog going mad, it is not unusual to remove it. Pliny recommends the worming of dogs, and from his time to the present it has had its advocates. The truth is, however, that the removal of the worm does not protect the dog against the disorder, but renders him incapable of communicating it to any other creature. The following facts will show how far it may be recommended for the restriction of a malady horrid in its effects, where a human being is concerned.

Three dogs that were wormed being bitten by mad dogs at three several periods, all died mad, but did not bite, nor do any mischief; for although one of them frequently ran at and attempted to bite a healthy dog in the same kennel, his tongue was so swelled that he could not make his teeth meet. The sound dog was kept in the kennel until the mad one died, and was purposely preserved for two years afterwards, to note the effect, but he never ailed, although no remedies were applied to check any infection that might have been received from the contact of the mad dog. To prove the use of worming, three more striking instances may be adduced. A terrier bitch went mad, that was kept in a kennel with forty couple of hounds; not a single hound was bitten, nor was she seen to offer to bite. Every attention was paid to her, and the gradations of the disease (which were extremely rapid) minutely noted. The rabies was fast approaching before she was separated from the hounds, and she died the second day after. At first warm milk was placed before her, which she attempted to lap, but the throat refused its functions. From this period she never tried to eat or drink, seldom rose up, or even moved; the tongue swelled very much, and long before her death the jaws were distended by it. In another case, a spaniel that had been wormed, was observed to be seized and bitten in the lip by a mad dog. Medicine was applied, and every precaution taken. Upon the fourteenth day he appeared to loathe his food, and his eyes looked unusually heavy; the day following he endeavoured to lap milk, but could swallow none. From that time the tongue began to swell; he moved but seldom, and on the third day he died. For many hours previous to his death, the tongue was so enlarged that the fangs or canine teeth could not meet each other by upwards of an inch. The forty couple of hounds already mentioned were all wormed, and several of them were bitten and went mad, but only one of them attempted to bite, and this was a hound in which one half of the worm had [illegible] owing to his violent struggling during [illegible] died with symptoms similar to those [illegible] violent swelling of the tongue,

and a stupor rendering them nearly motionless, and both which symptoms seemed to increase with the disease.

Though it has been questioned whether rabies has ever been produced spontaneously, or whether it has not always originated from the bite of a rabid animal at some period or other, yet there can be no doubt that it is often accelerated by the savage custom of dog-fighting. Mr Youatt says that rabies is disseminated in a tenfold degree by the dogs used for fighting than by any other breed; hence the suppression of that barbarous sport would much help to lessen the disease. Hydrophobia may be acquired not only from the dog, but from a rabid wolf, fox, jackal, cat, horse, ass, mule, ox, sheep, and hog, and even from a goose, duck, hen, &c., that have been bitten, but varying in the symptoms and degree of virulence. Franzius says, "if a fox runneth mad, he hath the same qualities as a mad dog; and if he bites any one, it is venomous." * It may be mentioned that the late Duke of Richmond died from hydrophobia contracted from the bite of a mad fox in Canada. All warm-blooded animals seem subject to rabies, but it has not been observed in any of the cold-blooded creatures.

Various signs by which a mad dog may be known are mentioned by authors, but as not even two out of the several accounts I have consulted perfectly coincide, and much that is stated seems to be fanciful, it is by no means easy to learn the true diagnostics where there exists so much mistake, contradiction, and inconsistency. I greatly question whether many authors have actually observed the successive stages of rabies from its commencement in the dog to its termination. Some, too, seem to have construed the eccentric peculiarities in the conduct of a queer dog or two into veritable symptoms of approaching rabies; but being a little singular, is not the same thing as being rabid—a fact familiar to those who have read of the eccentricities of authors. Simply because he is the latest writer on the progressive symptoms of rabies, I extract the following remarks by Mr H. D. Richardson, who says—

One of the earliest symptoms of rabies in the dog is *restlessness*. He is constantly turning round and round before he will lie down; his countenance becomes anxious, his eyes bloodshot; he fancies that he sees objects around him which have no real existence, and he snaps at the empty air; his fondness for his master increases, and with it his propensity to lick the hands and face—a filthy practice at any time, and one most dangerous; the appetite becomes depraved, his natural food is neglected, and at the same time every sort of trash is greedily devoured; *eating his own excrement* is an early symptom, and so sure a one, that the moment a dog is seen doing so he should be destroyed, or at all events confined. If he rubs his paws against the sides of the mouth to remove a bone, the mouth will remain open; but when his doing this is the precursor of rabies, the jaws

* *History of Brutes*, 1670, pp. 140, 142.

close after the rubbing ceases. There soon follows an insatiable thirst, so insatiable that the poor animal often plunges his whole muzzle into the water; and here you may observe *spume* left upon the surface. Soon the dog falls or staggers, and sometimes, but not invariably, becomes delirious. Death speedily ensues.

Mr Richardson then proceeds to speak of another sort of rabies which he calls dumb madness—

—chiefly characterised by stupidity, and at the same time restlessness of demeanour, by the tongue becoming of a dark colour, and much swollen, the animal constantly rubbing its jaws with its paws, as if seeking to remove a bone from its throat, and is in general unable to keep its mouth shut, or the tongue within it.*

An anonymous author states that a really mad dog on being pursued displays no signs of fear, generally going, if not impeded, in a straight line against the wind, at a brisk trot, wholly unconcerned at the shouts of its pursuers, and does not curl the tail in any direction, but carries it drooping. He adds, that a dog that curls its tail is certainly *not* mad. Some say that a mad dog will often worry a stone; and that when he is struck, he never growls, but is quiet.

It appears that rabies in dogs is sometimes cured, for a dog having bitten a man, the man died, but the dog recovered. Again, there have been instances in France of dogs being bitten by mad foxes, without catching the disease.

A slight scratch from the tooth of a mad dog is as dangerous as a bite, and so also is its being suffered to lick the hands or face. Some time since a lady of rank died of hydrophobia, contracted by permitting her pampered French poodle to lick her face, on which she happened to have a sore pimple, which of course imbibed the virus. When a person is bitten through his clothes, there is less danger, as the teeth of the animal become wiped or cleaned in passing through the cloth. The wound made by a mad dog heals, like any other wound, but considerable pain extends from it along the course of the nerve, and not of the absorbents, which are never affected. The common and decisive symptoms of hydrophobia in man are, at first, dejection of spirits, increasing from melancholy to fury, spasms of the muscles, of the throat and chest, an extraordinary aversion to the name and sight of liquids, and an excessive flow of spittle. Between the infliction of the wound and the appearance of any symptoms, some time elapses; generally, the disease shows itself between the twentieth and fortieth day; occasionally it appears at a shorter or at a much longer interval. In a hundred and thirty cases it was remarked that it commonly appeared at some period between one and three months. It rarely evinced

* *Dogs, their Origin and Diseases* (Dublin, 1847), p. 109.

itself after the fourth month. Cases, however, are reported of the virus remaining for a much longer time in the constitution. Thus, in the *Philosophical Transactions*, a case is mentioned of a man attacked with hydrophobia, nineteen months after the bite. We are also required to believe that in a case which occurred under Dr Bardsley, at the Manchester Infirmary, twelve years had intervened.

Sir Astley Cooper, speaking of the preventives of hydrophobia previous to any decided symptoms having appeared, says, that the best mode that can be adopted is, immediately after the part has been bitten, to ascertain by means of a probe to what depth the teeth have entered, and then take care to cut out a sufficient quantity of the wound, letting no injured portion of the integument cellular membrane or muscle remain. He believes that in every instance where this careful excision of the part has been done immediately after the injury, the disease has been effectually prevented. In cases where persons foolishly object to have the poisonous part cut away, he advises that a small piece of the potassa fusa should be let sink into the wound; it will readily dissolve, become liquid, its cauterising influence being communicated to each pore of the wound, and thus destroy the influance of the poison. As a remedy when hydrophobia has decidedly set in, he thinks the only thing calculated to do good is M. Magendie's prescription; namely, the injection of warm water into the veins. To make the employment of this remedy safe, and to prevent pressure on the brain, there should be abstracted a quantity of blood equal to the quantity of water intended to be injected. Probably, instead of bleeding previously to the injection of the water, it would be the better plan to let the blood flow from one vein, while the water is thrown in at another.

In the course of their practice, Messrs Youatt and Blaine, and Dr Ainslie, were bitten at different periods by rabid dogs, and also operated on some hundreds of persons who had been bitten by rabid animals, and in no instance did loss of life ensue therefrom. Dr Ainslie recommends that the person bitten should as soon as possible thoroughly wash and cleanse the wound, not suck the poison from it, as is too commonly done, for inoculation may take place by an abrasion on the lip. If the wound be superficial and ragged, let the edge be removed with a pair of scissors, and then apply freely to every part the nitrate of silver, commonly called lunar caustic. If the wound be a punctured one, as in some cases it is, from the tusk of the animal going deep into the flesh, the stick of caustic must be carefully pointed, that it may reach the bottom; if necessary, the wound should be enlarged, care being taken in the use of the knife, or the virus may be carried by it over the fresh surface. The nitrate of silver

destroys the surface of the wound, and neutralises the virus, which comes away with the destroyed surface, without the absorbents acting upon it; and if freely applied to the part affected, the patient may feel himself perfectly safe. Instead of the application of a poultice after the operation, it is advisable to let the wound be exposed to the atmosphere; and should any inflammation ensue, it may be relieved by dressings of olive oil. The lunar caustic seems to reach every part of the wound, and is useful in the case of quadrupeds as well as human patients. Mr Youatt relates that in the spring of 1827 four horses were bitten near Hyde Park by a mad dog. One of them, to which the caustic was twice applied, and freely, lived; while the others, on whom the red hot iron was unsparingly used, all died. A French surgeon is reported to have cured a little girl by cauterising two black pustules which appeared under her tongue, which are said to be characteristic of this disease, and to contain virus.

Dr James Johnson states that while he was surgeon at Chittrah, in India, a vast number of persons that were bitten by mad dogs and jackals came under his care, and that, in every instance where he had impregnated the system with mercury after the infliction of the bite, hydrophobia was prevented; while many who would not consent to this course of treatment, perished by this dreadful malady.

It is stated that a poor man of Udine, in Italy, was cured of hydrophobia by taking a quantity of vinegar given to him by mistake for some other medicine. Count Leonissa subsequently restored a patient to perfect health by administering to him a pound of vinegar in the morning, and a like quantity at noon and night.

The roots of the greater water-plantain (*Alisma plantago*, Linn.), which grows in rivers, lakes, and marshes, being gathered in August, then well washed, dried in the shade, and reduced to powder, are said to have effected numerous cures of the disease, particularly in the government of Zula, in Germany. The powdered root is strewed upon bread and butter, and given to the patient two or three times. On the second, or at most the third time, the Hamburgh journals tell us, it will destroy the virus, however intense it may be, even when the symptoms of hydrophobia have already appeared. We are assured that it acts with equal efficacy on dogs which have been bitten, as well as on mad dogs, and that during an interval of twenty-five years, it has constantly been found an infallible specific against rabies and hydrophobia; curing persons in whom the disease had acquired so decided a character, that they attacked and bit all who came [illegible] them. No symptoms of relapse were ever observable. Sir [illegible] Carlisle relates that the method of curing hydrophobia

in South America is to put the patient up to his neck in sand or earth, and pour down his throat by force, as soon after the bite as possible, two ounces and a half of the extracted juice of a species of *cactus*, which has also been found efficacious even when given after confirmed symptoms of the disease have set in. The cactus plants, moreover, are well known to be harmless in their effects; some of them being used as salads, and cattle being fed on others when there is a scarcity of grass.

In severe cases of hydrophobia where it has been impossible to get fluid remedies down the throat, the endermic method of administering them has been resorted to. This process simply consists in removing the scarf-skin by means of a blister, and then sprinkling the medicines on the exposed surface, where they have been found to act as rapidly as when taken into the stomach.

Lieutenant Hardy informs us that in various parts of South America rabies is extremely common. In the long summer, when all the streams are dried up, the wild beasts tear their flesh in agony with disease, the wolves, and canine tribe generally, being the especial sufferers; but the jaguars or tigers, and perhaps all that roam the sandy plains, are seized with this fury. Accidents from this cause are, therefore, common among the hunters, herdsmen, and poor people in general; but they excite comparatively little terror, from the frequency and simplicity of the cure. This is effected by taking two or three doses of a powdered root, which seems to be allied to the hellebore. It throws the patient into a most copious perspiration; the second day generally completes the cure, though the patient remains feeble for a time. It is remarkable that this root acts in the same manner as the medicines which have been found to be palliatives of this disease in Europe. Sudorifics seem chiefly to have produced any effect here; and some instances of the singular force of the vapour-bath in quieting the paroxysms have been recorded, and may lead to a more skilful treatment. The root in question has been brought to England and administered, but, as is reported, without effect. Still, we must suspend our belief that a root which cures in South America can become utterly useless when it crosses the Atlantic, and we hope that further experiments will be made with it.

Peltidia canina, a species of lichen, was formerly used, at Dr Mead's suggestion, as a cure for the bite of a mad dog, whence its specific name.

An American physician asserts that a few drops of any mineral acid applied to the wound received from any rabid animal will decompose the poisonous saliva, and prevent hydrophobia ensuing. Mr Murray, too, recommends that a mixture of two parts

of nitric and one part of muriatic acid (evolving chlorine in a concentrated form,) be applied to the wound as soon as possible, and more than once. He thus treated the wounds of a man whose hand had been dreadfully lacerated by a mad dog, while separating another dog from its attack; and as the latter became also rabid, it afforded full proof that the rabid virus in the former was at its height of malignity. The man lived above fifteen years after the occurrence, and continued free from hydrophobia. M. Tschiffeley, of Blois, believes that the external application of essence of turpentine would be efficacious. Colonel Gattacre, of Shropshire, on being bitten by a mad dog, put a pinch of gunpowder into the wound and immediately exploded it; and he lived for several years after the occurrence.

A writer in the *Edinburgh Journal* recommends that after every or any bite, no matter how slight, that is received from a dog or other animal, very hot water should be poured from a tea-kettle into the wound, the vessel being held four or five feet above it; if a common syringe, or squirt, is at hand, the water should be injected into the wound; and this ablution should be carried on for three or four hours. Mr Peter Hood suggests to me that, as hydrophobia is a disease of violent excitement, the sufferer might derive benefit from cold water plentifully applied from a height, along the whole extent of the spine; the sedative effect of cold water being well known.

In a letter to the *Times* newspaper, Mr John O'Reilly states that most of the professional men and all the people of the counties of Cavan, Leitrim, and Fermanagh, believe that a family named M'Gawran, residing near Swanlibar, possess a perfect remedy for hydrophobia. "In this family," says he, "the receipt has been hereditary since the Scoto-Phœnician invasion of Ireland, and is kept by them a profound secret. Persons and cattle have been taken to them tied on a car, and returned free of all illness. The coroners' records prove that no deaths from hydrophobia have occurred in the above counties."

I have met with some singular superstitions relative to the curing of hydrophobia. In Murray's *Guide to the Beauties of Scotland* there is a story of this disease having been cured by the Lee Penny, a trinket which our ancestors supposed was a miraculous antidote for all diseases. "About the year 1700, Lady Baird, of Sauchtonhall, near Edinburgh, having been bitten by a mad dog, was come to the length of the hydrophobia; upon which, having begged that the Lee Penny might be sent to her house, she used it for some weeks, drinking and bathing in the water it was dipped in, and was quite recovered." Ben Jonson, in some verses written in 1640, alludes to another strange notion:—

——He is bitten by the dog he fed,
And hurt seeks cure, the surgeon bids take bread,
And spunge-like with it dry up the blood quite:
Then give it to the hound that did him bite;
Pardon, says he, that were a way to see
All the town-curs take each their snatch at me.

In M. Le Clerc's treatise entitled *La Médecine Aisée* (Paris, 1719) it is recommended as a mode of cure to lay upon the wound a hair of the dog that has bitten the patient. Surely this ridiculous prescription must have given rise to the jocular advice given to persons who are sick from the effects of drunkenness the night before, namely, "to take a hair of the same dog that bit them last night;" that is, to take some more drink.

Before concluding this article, I may mention that it is asserted that very many persons bit by an animal have been so alarmed as to die, not of hydrophobia, but with similar symptoms, occasioned by fear preying on the imagination. Hunter nearly fell a victim to this fear. Dr Bellanger, of Senlis, even asserts that hydrophobia is entirely a disease of the nervous system, developed only by the influence of the imagination.

Notes on Electro-Culture of the Potato Crop of 1847.—By Mr George W. Hay, Whiterigg, Roxburghshire.—*June* 10. Placed wires around a plot of potatoes, the size of which was seven yards broad by 28 yards long; enclosing ten drills, leaving five drills on the east side, and four drills on the west, outside of the wires.

Two stakes of about four feet in height were driven at the middle of each end, and a pole of eighteen feet was placed in the centre of the plot. A wire was passed over the pole and stakes, and connected with the wire which enclosed the plot; the whole being made one continuous wire.

The drills lay directly north and south, and the wire was sunk to the depth of about three inches, parallel to the drills on the sides, and to the same depth across, care being taken that the whole was done in an accurate manner.

July 17. Up to this time the whole plot of potatoes, whether within or without the wires, exhibits the same degree of vigour, all being of a dark-green colour, and perfectly healthy as far as can be seen as yet, both in the stem above and under ground, and also in the young tubers.

July 24. Carefully examined the whole plot, both without and within the wires, and found that the stems and leaves were quite sound; the tubers were also quite fresh—not a speck upon them; the old sets even in many cases being perfectly sound, and not a vestige of speck on them. Had a few of the tubers boiled,

and they were as good as young late potatoes generally are at this season—some of them as large as hens' eggs.

Complaints are beginning to be made in the village (Bowden) that the disease is showing itself.

August 20. Examined all the potatoes, and can discover no evidence of disease either on the stems, leaves, or roots, of those which I lifted. The green and healthy appearance still continues; and there seems no difference between those within from those without the wires—all seeming alike vigorous.

September 6. Commenced lifting the potatoes from the ends of the drills to the north of the rows, and found all the potatoes sound, and an excellent crop; did not see a single diseased potato, and the stems quite fresh; no blackening of the leaves, although there have been very high winds lately; and in most places around, the wind has blackened the leaves.

I consider, that, although the potatoes are not quite ripe, it is better to lift them at present, so long as the dry weather lasts, rather than run the risk of getting them destroyed by wet; besides, the tuber is found to be better adapted for seed, when taken up before it is thoroughly ripe.

September 9. Had the whole of the potatoes lifted to-day, and the people who were engaged in raising them did not see a single diseased tuber. I may mention, that there were thirteen drills of pink-skinned potatoes, and six drills of purple-skinned, which were some years ago black throughout, and changed from that to very white within the purple skin.

Of these purple skins two drills were carefully measured, when lifted from the outside of the wires, and two drills from within, so that a right estimate of the benefit derived from the electro-culture might be obtained. Four drills of the pink-skins were also measured from either side of the wires on the other side of the plot. A bushel of each was weighed, to test the comparison completely.

2 Drills, purple, without the wires to the west, gave 3 bushels;—weight per bushel, 4 st. 12½lbs.

2 Drills, purple, within the wires to the west, gave 3 bushels;—weight per bushel, 4 st. 12½lbs.

4 Drills, pink, without the wires to the east, gave 5½ bushels;—weight per bushel, 4st. 9½ lbs.

4 Drills, pink, within the wires to the east, gave 5½ bushels;—weight per bushel, 4st. 9½ lbs.

It will be seen by the quantity and weight, that no difference existed between that part without, from that within the wires; in fact, it seems to me quite clear, that no advantage is to be derived from the trouble and expense consequent on *electro-culturing* the ground: and I am the more persuaded of this being the result,

from the subject having been abandoned by those who were its former advocates. I had fully expected that my failure last year would have produced from some other party a counter statement, but I suspect that all who have tried the experiment have met with like disappointment, as no notice has been taken of experiments on electro-culture, so far as I have seen.

It is possible that some change might yet have taken place, had a course of wet weather set in; but I preferred having my potatoes saved previous to the ground becoming wet, rather than continue the experiment, and probably lose a portion of the small quantity I am in possession of.

I would not have been induced to try the electro-culture again this year, had I not seen in the "Border Watch," that a crop of potatoes had last year been saved by that process; and I was tempted, on that account, to adopt as a precautionary measure for the safety of this year's crop, what was given out as an effectual remedy for the complaint of last year.

Carrots in Reclaimed Bog. By Mr P. MACKENZIE, West Plean, Stirling.—There are numerous deposits on the surface of the earth which will yet be improved, and, when properly done, will yield nutritive food for men and cattle. There is the matter carried down by rivers, and deposited beside the banks, or in islands at their mouth; this is called alluvium; there is the accumulation of decayed vegetable matter, mixed with water, named peat; and there is what is called vegetable soil, composed of the inferior substances in a pulverised state, or of detritus carried from a distance, mingled with decayed vegetable and animal matter.

These deposits will vary in value according to circumstances, such as the geological formation in which they are placed in their local situation; but much may be done profitably to reclaim them, so that instead of generating pestilential vapours, and lowering the temperature of the country, by removing the superfluous moisture, the spot would smile with plenty, and the sun would shine more kindly upon it. For instance, it is more than five hundred years since the battle of Bannockburn, and, as far as we know, Milton bog, which was used for a certain purpose that day, has remained till within a short period marshy ground. We confess we have often botanised about it with feelings we cannot describe; and when gazing upon the white water lily floating on its surface, we have thought upon the horse and its rider that perished in the snare set for their destruction. Perhaps the archæologist would have wished it to remain, although it might be a fountain of carburetted hydrogen gas evolved by the mud at the bottom of its stagnant waters, where it arises from the decay of vegetable matter, and thought himself well rewarded

by fishing up, in dry seasons, the head of an old spear, or the musty remains of a horse's shoe; or the curlers may lament that the waters are gone, on whose glassy surface they have often joined in the animating play; but patriotism, if it borders on selfishness, and the objects of the antiquary if they stand in the way of improvement, must give place to that which must ever be counted a blessing to every land, namely—peace and plenty. A deep level has been made, and the bog is drained; and it was pleasant to witness luxuriant crops of grain growing where once the *Glyceria fluitans* grew in abundance, and where there were only bog-hay, and plenty of *menyanthes trifoliata*, and *juncus*, and *carex*, and *iris*, and *nymphea*, and *equisetum*, and *alisma*, and *arundo*, and *callitriche*, and *caltha*, and *potamageton*, and many other plants not reckoned of great value as food for the human race; and where such plants lately grew, there is now an excellent soil for various sorts of grain and roots. Last season, a white carrot grew in it weighing 5 lbs., and an Alteringham weighing 3 lbs., and an early horn carrot weighing 2 lbs., which might have been seen at Drummonds' Agricultural Museum in Stirling.

There are many such bogs in Britain and Ireland as good as the Milton, and as capable of improvement; and what a treasure it must be to have a good carrot soil, and a climate to grow them! It is said of the carrot, that the importance of it as a general field green crop, is not sufficiently recognised; and although its cultivation is attended with a considerable amount of expense and labour, yet, parsnips excepted, there is no other field vegetable that yields so great a quantity per acre of nutritive matter, or is as much relished by all kinds of stock; and one reason why the carrot sometimes fails, may be owing to the nature of the soil in which the seed is sown, for they will not thrive in all sorts of soil, any more than cattle will fatten on all sorts of food. The "Vegetable Cultivator" says, respecting the carrot—

> In the culture of this nutritious and useful vegetable, a deep, light, rich, sandy soil should, if possible, be employed. The soil should be well manured the preceding year, for if the manure is applied at the time the seed is sown, the roots are apt to be affected with the canker. If the ground is not of the quality above mentioned, it should be trenched to the depth of 18 inches at least, and at the same time well broken; for if this is not done, the roots are apt to spread in a lateral direction, and become branched.

It is well known that all bog land has not the above properties, but there is what may be called alluvial bog—that is, where a considerable quantity of water enters the boggy ground, conveying with it heterogeneous particles of matter; and in times of floods no small quantity of fine sand and clay; the waters moving slowly through such places, much of the matter brought in by it is left behind among the accumulating vegetable substances that are yearly increasing. Such soil, preparing for ages, is well fitted

for the growth of carrots, when properly prepared. It is different from the peat moss or bog described by Morton in his work on soils :—

It is composed of an accumulation of vegetable matter in a half-decayed state, which has undergone, and is undergoing, changes different from the ordinary decay of vegetable substances. It consists of a light, soft, spongy substance, holding water in excess by capillary attraction; but when dry, it is inflammable, burns with little or no flame, and changes its colour, on being exposed to the atmosphere, from a brown or yellow to a blackish colour. It is formed by the growth and partial decay of aquatic plants in a cold wet soil, or in stagnant water, in hollows, or hollow basins, either on low or on high land; in many instances it is semi-fluid, and so soft that neither man nor beast can pass over it. The water is antiseptic, from tho tannin principle of the plants of which it is composed; and as the tannin principle of moss has the power of preserving animal and other substances for a great length of time, their decay is gradual, and very slow.

Judging from the experience we have had in the cultivation of carrots in such soil as now described, it should not be so much relied on as that which may be called alluvial bog; for, after it had been broken up, trenched, and dunged in the autumn, it did not yield the return that was expected from it. But as the quality of peat differs in different localities, some parts may be better prepared for certain crops than others. But the following extract on the subject from an agricultural work, may be none the worse for being better known :—

It is but recently that the farmer's attention has been directed to the extended cultivation, as field crops, of the parsnip and the carrot, and that in soils where it was deemed useless to make the attempt. Thus, the white or Belgian carrot was sown by Mr Morton at Whitfield in the second week of April 1840, by the Suffolk drill, on a deep sandy soil belonging to the new sandstone formation, and the produce was a crop not only more valuable per ton than any other green crop we have, but raised at an expense less by at least one-half than that attending the cultivation of the turnip. It weighed 26 tons 3 cwt. per acre. It seems, according to Mr W. B. Harris, that the white carrots generally exceed the red ones in weight from 8 to 9 tons per acre, and that the soil intended for them should be subsoiled. The Yoxford Farmers' Club recommends strongly the cultivation of the long white carrot, which is excellent food for cart horses, from its producing a heavy crop adapted to strong as well as mixed soils. There are, says Mr Pusey, two varieties; the best is that which makes a large portion of its root above ground. It has been grown very successfully by Sir C. Burrel in Sussex, and in Jersey. According to Colonel le Couteur, the prize crop of parsnips afforded, in 1841, 23 tons per acre, while the white carrot prize crop rose nearly 38 tons per acre. And it is by no means necessary to have so deep a soil for them as the farmer commonly believes. Thus, in an experiment by Lord Ducie, in 1840, at Hill farm, with the early horn carrot, on a wheat stubble, the soil is only 5 inches deep, and the seed was drilled without any manure, six inches apart, on the 22d of March, yet the produce of these was 18 tons 15 cwt. per acre. They are described as excellent food for fattening sheep, particularly when used with bean meal. They will, on many soils, be found a valuable assistance in the support of the farmer's stock.

Before concluding, we may state what has been ascertained to be the proportion of gluten in an acre of carrots, compared with

that of turnips. Boussingault informs us, that the flesh of domestic animals contains 17 per cent of fibrine and albumen, and that these are analogous to the gluten of vegetables; and an acre yielding 25 tons of carrots gives 1120 lbs. of dry gluten, and, when consumed by cattle or horses, produces 6527 lbs. of muscular flesh, whereas 25 tons of turnips give only 3941 lbs. Such statements by chemists should not be forgotten by the growers of field crops and the feeders of cattle; and it may be to the advantage of both, to give more attention to the nature of the soil and food of carrots, as well as to the quality of the seed, its proportion for sowing, its distance in the drills—in short, the best mode of cultivation that has yet been given.

The Composition of the Ash of Turnip-tops. By Mr ROBERT M'CALMONT, Third Assistant in the Laboratory of the Agricultural Chemistry Association.—It is now generally admitted by practical farmers that turnip-tops, when given to cattle, either alone or along with the bulbs, exercise a beneficial and nutritive influence, which may be traced to two causes.

1° They contribute to build up the bones of the young animals much more than the bulbs do. This is owing chiefly to the large amount of phosphates which they contain, as will be seen by the following analysis, made by Professor Johnston:—

Carbonates of potash and soda	16.11
Sulphates of potash and soda	22.46
Chlorides of potassium and sodium	14.02
Phosphates of lime and magnesia	36.39
Carbonates of lime and magnesia	10.10
	99.08

Earthy phosphates enter largely into the composition of the bones of all animals; those of the cow have been found to contain—

Organic matter (gelatine)	33.25
Phosphate of lime	55.50
Phosphate of magnesia	3.00
Carbonate of lime	3.75
Soda and common salt	3.50
Chloride of calcium	1.00
	100.

The principal object to be aimed at, in the rearing of young animals, is to bring them to a large size, and early maturity. In the tops of the turnips, there is a large quantity of material, that will greatly assist towards attaining the first of these objects, by tending to lay down a large frame-work of bones.

2° When the tops are given to milch cows, along with the bulbs, the cows have been found to yield a larger quantity of milk.

1000 parts of milk contain from 6 to 10 per cent of inorganic matter, which is chiefly phosphate of lime. This inorganic matter the cows must receive in their food, or else they could not yield milk.

The tops contain a far larger proportion of this inorganic matter than the bulbs do, and will, therefore, yield more of this kind of nourishment, weight for weight, than the bulbs will.

This is an important consideration, as the tops are frequently allowed to be lost, so far as regards the feeding of stock, they being sometimes used as green manure.

In Sussex, turnip seed is sometimes sown at the latter end of harvest; and after two months, the young plant is ploughed in with great advantage to the land. The tops of our turnip crops are, however, more generally ploughed in after the bulbs have been carted from the field, for the use of the cattle, and to make room for the succeeding corn crops Their economical use as a green manure is partly owing to the inorganic, and partly the organic matter they contain.

In the *Annalen der Chemie und Pharmacie*, vol. lix., p. 264, there is given an analysis of the ash of turnip-tops, by M. Namur of Luxemburg, in which the proportion of phosphoric acid is very much smaller than was found by Professor Johnston. At the request of Professor Johnston, therefore, I have repeated the analysis of the ash of some turnip-tops, grown at Liberton, in the neighbourhood of Edinburgh. They were of the globe kind, and were grown on a rather stiff clay soil. At the time of pulling, they were fully matured.

The quantities of water and ash were first determined, and were found to be as follows:—

Water	82.38
Ash in the undried leaf	1.53
Ash calculated dry	18.63

I next prepared a quantity of ash, for an analysis, by burning the leaves at a moderate heat, to prevent fusion, in a platinum vessel, over a glass lamp. The result of the analysis was as follows:—

Potash	16.42
Choride of potassium	9.61
Chloride of sodium	6.65
Lime	22.98
Magnesia	2.87
Oxide of iron	0.42
Sulphuric acid	16.31
Phosphoric acid	9.22
Carbonic acid	13.18
Silica	1.39
	99.05

Another analysis of a different sample of ash, made in the laboratory by Dr Fromberg, gave the following result:—

Potash	13.02
Chloride of potassium	19.55
Chloride of sodium	8.55
Lime	20.60
Magnesia	2.74
Oxide of iron	0.76
Sulphuric acid	11.09
Phosphoric acid	8.22
Carbonic acid	13.83
Silica	0.76
	99.12

Or these two analyses given in compounds—

	Fromberg.	M'Calmont.
Sulphate of potash	24.07	30.35
Chloride of potassium	19.55	9.61
Silicate of potash	1.92	3.52
Chloride of sodium	8.55	6.65
Phosphate of lime	14.74	18.60
Carbonate of lime	23.10	23.13
Carbonate of magnesia	5.70	5.94
Phosphate of iron	1.83	1.01
	99.46	98.81

The analysis of M. Namur, which gave rise to the present investigation, was as follows:—

Silica	6.144
Sulphuric acid	1 332
Phosphate of iron	4.003
Magnesia	7.447
Potash	29.529
Soda	2.107
Phosphoric acid	1.176
Chloride of sodium	3.251
Lime	25.510
Carbonic acid	19.501
	100.000

Leaving out of the question altogether the large and unlikely proportion of silica in this analysis, and other differences of smaller importance, which might have been accidental, it will be seen that the phosphoric acid altogether amounts to about two per cent.

Another point to which I would draw attention is, that there are not enough of acids present to saturate the bases, as will be seen by the following numbers, which represent all the combinations the acids are capable of forming:—

Sulphate of potash . . .	2.90
Silicate of potash (sesqui basic) . .	15.55
Chloride of sodium . . .	3.25
Phosphate of lime (tri basic) . . .	0.72
Phosphate of magnesia (tri basic) . .	1.60
Phosphate of iron	4.00
Carbonate of lime	44.63
	72.65

Leaving of bases, which there is no acid to combine with—

Potash	18.54
Soda	2.16
Magnesia	6.70

It is of very great importance that this investigation should have been made, as one of the principal ingredients to be sought for is the phosphoric acid. The above facts satisfy me that the analysis of M. Namur has not been made with sufficient care, and at all events, that it is not in the least to be relied on, as an expression of the composition of the ash of turnip-tops grown in this country.

Condition of Agriculture.—Drilling—Dibbling. By MR TOWERS, M.R.A.S.—We are certainly on the advance, but there is a want of assured, fixed principles. This, perhaps, is to a certain extent unavoidable—or rather, it is a consequence of the uncertainty to which our climate is subject, in its meteorology; and of the vast existing varieties of soils and subsoils. But, independent of these natural contingencies, the writings of our best authorities, the tenor of all the reported proceedings and debates at farmers' clubs, and the utterly opposite practice that we meet with in the several counties, and even in localities not remote from each other—all these variations prove, how far ignorance of causes and principles prevails. It therefore has occurred to me, that, by passing in review some of the leading points now advanced by men of practical experience, and by comparing these with the results observed in different situations, a step may be taken towards something like a consistent theory of agriculture.

Chemistry has of late become a subject of conversation; but much as I admire its science, and assured as I am, by my own experience in the laboratory during a course of years, of its analytic powers, I cannot feel that the exhibitions and display of its agencies at the public lectures, have produced any happy results in the farm. Farmers are not yet prepared to listen to, or in any degree comprehend, much less to apply, the symbolic equations of organic analyses. What is wanting to agriculture, so far as concerns chemistry, are public institutions; of which Scotland furnishes a magnificent example, in her Agricultural Chemistry Association, directed as it is by that able and faith-

ful philosopher, Professor Johnston. Until young men of intellect can be educated at colleges, or such places, wherein the science of chemistry is explained in all its bearings upon agriculture, great advances cannot be made. No one acquainted with the power of re-agents can for a moment question the utility of analysis in determining the constituents of soils and composts. But the practical labouring farmer of the present day could not be expected to act for himself. The value and extensive utility of the Scottish Association are proved by its performances, and by its published periodical reports. All Britain ought to possess institutions of this kind, where specimens might be examined, and wherein the rising generation of agriculturists might be instructed to appreciate, and apply the principle of chemical re-agency.

Till that system of scientific agriculture be fully developed, the energy of every one who is any way interested, whether as landowner or tenant, ought to be directed to those appliances which are known to increase and improve the productions of the ground.

During the many years that I resided in the east of Berkshire, I could not but remark the monotony, if I may so apply the term, that obtained in its ordinary farm routine. The capabilities of the arable land were very great, but there appeared to be little emulation abroad—one heard of no improvement—operations were conducted on the same scale; and though an exception might exist, yet it was a new occurrence to hear of drainage, or of any experiments with manures. I am not aware that bones in any form had been applied on any farm; a little guano was tried, during the years 1845 and 1846; and thus, in the main, everything went on in the ordinary routine of the "good old times;" that is to say, at a period when the fathers of the existing generation had been enabled to realise the enormous prices created by the late French war, during its frightful course of twenty-two years.

Previously to 1822, I had many opportunities to observe the far more generous and high order of farming practised in the Isle of Thanet, in Kent. There every thing prospered; no expenses were spared—the powerful turn-wrest plough laboured the grateful loamy stratum resting upon the solid chalk rock, to perfection, which, though in many instances of very inconsiderable depth, was still so generously treated, that the return was, almost without exception, equivalent. The farmers in that natural "granary" possess two great advantages—they of the first class are generally proprietors; and again, having plenty of manure at command, they apply it liberally, with abundance of sea-weed; and as the *subsoil* of chalk-rock is so pertinaciously retentive of water that the rootlets of any plant which reach it never perish

by aridity, it of course also becomes an inexhaustible storehouse of the rich drainage-water that percolates the loam. Finally, the same absorbent and retentive medium acts most beneficially, by receiving and effectually holding all the superfluous water which may fall during the wettest seasons—and hence the old "saw"—

When England wrings,
The Island sings;

for *that* profusion of water which would ruin a clay district, passes off innocuous into the chalk masses on the east of Kent.

The county of Surrey comprises a great variety of soils. Toward the west, on the line of the South-Western railway, from the neighbourhood of Kingston toward the Hampshire boundary, a wretchedly poor silicious sand abounds, and, therefore, little can be said of its agriculture. Plastic clays occupy a rather narrow belt, extending from the Hampshire to the Kentish border; and chalk is abundant, at greater or less depths, through very extensive but irregular portions of the county. In and about the vicinity of Croydon, loams of the finest quality are distributed; and I make the allusion in this place, with the express object of introducing some remarks, which suggest themselves from my own direct observation of what I consider examples of exceedingly good agriculture, worthy of all admiration, and calculated to stimulate those who, unfortunately, are in arrears, not only in this immediate neighbourhood, but throughout the whole of the kingdom.

The *soil* of a district must to a very great extent regulate its husbandry; but when one observes a piece of loamy land (the subsoil a pure chalk), whose depth may be indefinite—as for instance, in the extensive cliffs of Kent, or the swelling downs of Surrey and Sussex, consisting of a stratum of free-working hazel loam, sufficient to support heavy grain crops—he feels certain, that wheat, oats, or barley, ought to grow equally throughout. But how stands the case? A field shall comprise, perhaps, twenty acres, and is cultivated by two farmers. A has called in aid all that he believes to be the principles of good, remunerative farming. He has sown wheat early in October, and no particular casualty occurring, he perceives, on the first of March, his plant to be equable and strong, but not tall or rank. B sows the same crop; a mere line, scarcely a furrow, divides the two portions, but the wheat advances irregularly; the plants are patchy and yellow. The period of secondary growth, from the development of the new series of roots attached to the tillers, or lateral offsets, is at hand: seasons and weather must of necessity correspond almost to a shade; yet, throughout the whole spring, A's plants shall be rich, and of the highest promise, while those of B can in no respect compete with them. Under these circumstances, the

discerning eye of one who is a close observer, rarely fails to discover, among the mass of poor and half starved plants, sundry spots of verdure, green as the oasis of the desert, and which evidently prove the existence of some cause, that cannot be appreciated by the farmer of the land.

Does not the reader feel the correctness of the case thus stated? Has he not in his mind's eye, numbers of instances which confirm its truth? Here, since my abode in this rich locality, I have traced twenty or more examples, which afford conclusive evidence, that, were the capabilities of England's soil tasked throughout, only up to the limits of common good tillage, its productive return would be in the ratio of at least five to three. I am perfectly ready to make every allowance for errors existing between landlord and tenant—of the injuries resulting from casualties—by weather, by insects, game, and other depredators; but I must claim the admission, that sound good farming is the exception, while its opposite proves the unfortunate rule.

We by no means pretend to instruct the practical farmer in particular minutiæ: every locality has its peculiarities; and of these, the parties who occupy are the best judges. But there are general principles applicable to all, which, if adopted, and efficiently carried through, are, almost to a certainty, productive of great results. The neighbourhood of Croydon, I repeat, affords examples which become the best possible instructors;—there, we find improvements of the greatest promise; and, what is more to the point, we perceive the undeniably manifest proofs of what can be effected in land of very low character.

"My farms," observes Mr Davis, "are naturally very poor; two are principally gravel, in parts very boggy and springy; very wet in winter, and burnt up in summer, having been reclaimed from heath only forty years. The third is a hill farm, with but few inches of soil, above chalk."

This statement can easily be confirmed. In some parts of Spring Park, I have seen masses of the *concrete* called plumpudding stone, which had been raised from the earth by force of abour, and now stand in mounds on a lawn, adorned with rockvork plants, as trophies of victory over a subsoil "pan," worse than noor-band," which threatened to falsify the axiom of the Latin oet, "Labor improbus omnia vincit." Hard labour, however, [illegible] up this pan, and meliorated the gravel. This labour is still [illegible]ed; it consists in what I would consider as *the first principle* [illegible] high and productive farming, namely, *ploughings*, deep as time [illegible] strength can a[illegible], occasionally made with the subsoil and [illegible] ploughs, go[illegible] sixteen inches deep, bringing to [illegible] as mu[illegible] [illegible] the fresh soil. This leading [illegible] Mr Davis'[illegible] always

implies *thorough-draining* to the locally required depth; otherwise, every future operation must be contingent. This fact the chapter *On Draining* (*Book of the Farm*, vol. i., commencing page 482), fully establishes, as does all the evidence laid down by competent persons who have spoken or written on the subject, within the last three years. I cannot consistently refrain from extracting the whole of the remarks which I find at pages 36 and 37 of Mr Davis's little work, *On the Resources of Farmers.* The writer, urging the necessity of employing professional engineers, or drainers, in the laying out of drains, says—

The usual practice is imperfect, and produces but a very temporary and partial cure, arising from leaving the execution of this very important amendment of land to bailiffs or tenants, whose want of scientific knowledge, and eagerness to save expense, lead them to adopt the readiest means, and at the least cost, to get rid of only so much of the evil as is made evident to their eye, by crops lying sodden in the winter season. To cure this, and under the impression that it is only from surface-water not sinking that the mischief arises, they cut a trench twenty-four or thirty inches deep, for the receipt of some *bushes*, and in this way suppose that all has been done to effect a cure, without examining into the source, and cause of the wetness, or even a desire to do more than to stop, for a time, the mischief. The wetness of land must arise from one or other of these causes—either from the water received on the surface not running off, or from springs rising in the winter, and overflowing; or from water drawing into hollows, faster than it can sink into the earth; or from a top porous stratum lying above an impervious one, and so receiving the rain, without letting it get away, and basining it as it accumulates. In order to effect a cure of wetness of land, it must be evident, that the cause and origin of the water found at the surface should be first ascertained, and the drainage made in such situation, direction, and depth, accordingly as the source be from top accumulation or under-springs, or collection from sources off higher ground. Wherever land is wet by springs rising, or from water collecting, or thrown *to* the surface by an impervious under-stratum, the drains should be as deep as the fall will admit; and four, five, or six feet, or more, will generally be found not only most effectual, but very often the most economical, by their durability, and the greater radius from which such drains cut off the source of wetness. Their situation and direction should be chosen with reference to the spot from whence the wetness can be traced, and the course in which the water soaks.

In some arable fields near Maidenhead, Berkshire, I have frequently observed, that, soon after spring ploughing and harrowing, the surface has appeared of one clear hazel brown; but, in a very short time, when the hot sun has dried the land, spots and patches of various sizes have become visible, being much deeper in colour than the tint of the general surface. Such land is springy—no heat will remove the stains—and this is the more remarkable, insomuch, that all the neighbourhood has a twofold subsoil of gravel and chalk, or chalk and gravel, varying, however, in depth and relative position. No one thinks of draining; but it is evident that there exist patches of concrete, low-seated, or a number of minute springs, either of which is irremoveable, except by the operation of efficient drains. The fact proves also that we may not always rely upon natural drainage, by porous or absorbent subsoils.

2. Next in importance to deep tillage, by which very inf land can be rendered a permanent foundation of future husbandry, and one that, even if badly managed, time cannc move, is the judicious application of the *drill.*

There are three methods of depositing seed corn in the each being peculiarly applicable to a certain texture and perament of the staple; namely, drilling, dibbling, and pres for I entirely exclude broad-cast on a rough surface, as a apology for idleness and want of foresight. Each of these admitted methods has its warm advocates; and as I disc the most remote intention to interfere with any thing th "well done," and is suitable to local circumstances, so I observe, that the drill, in nine cases of ten, possesses great ac tages beyond those of the dibble, because the depth of the can be thereby determined with greater precision; and a the seed will be deposited over an extensive surface, at a economy of time and money. As to the presser, it is an in ment that seems to confer the required solidity and firmne bottom, to land that is light and sandy; but in every in ment that I have seen employed, the press wheels are sel close together, to permit the carrying out of those fu operations which the system of improved farming requires.

Dibbling, in loams of medium texture, perhaps rather and sandy than otherwise, appears to me capable of affor a most instructive lesson; one which the inquiring young fa should not fail to learn, as by it he will become acquainte what extent the wheat plant can tiller (that is, develop la shoots from the collar), and how far economy of seed ca carried. I have tried three distinct experiments with seed-wl in dibbled holes or drills, deposited in hazel, rather bin loam, and have ascertained beyond a doubt that a single can, upon average calculation, produce about fifteen dis stems, each to terminate in a perfect ear, comprising from to sixty grains. Fearful of loss, I put three or four seeds hole; but I gained nothing by so doing; since, wherever de dation occurred, I found that the insect depopulated the e hole: never devouring in thinning order. I committed errors in sowing too late—November—and then being forc put up with a too wet state of the soil, which made the dista and depths uncertain. However, some great facts were de mined—1st, That either October, not later than the middl the month, or the early spring (February), should be ch 2d, That the holes should never be under 2½, or above 3 in deep, and made in dryish, certainly not clodding, soil; and Not less than 7 to 9 inches asunder, in rows, or ranks, tha

fully 12 inches apart. Seasons favouring, the result at harvesting would demonstrate how vast would be the product, and how reckless is the expenditure of seed-corn under the present system of farming.

While on the subject of dibbling, by way of instructive experiments I will copy a letter addressed to the editor of the *Sussex Advertiser*, by Mr F. Allman, nurseryman at Horsham in that county, dated July 16, 1844.

Having received a small quantity of wheat of very superior quality, from a gentleman recently returned from Australia, I prepared a small piece of ground in my nursery, which had produced a crop of potatoes in 1842; and in November of that year I dibbled in 682 corns, putting only one grain in each hole, planting it in rows 9 inches apart, and 6 inches from hole to hole; the ground measured 34 yards, or the 1-142d part of an acre; the grain planted weighed 18 drachms, which would amount to little less than 10 lbs. to the acre; so that a bushel of wheat would plant rather more than six acres.

The usual quantity sown in this neighbourhood varies from 18 to 20 gallons per acre. The wheat was put in without any manure after the potatoes, and no kind of top-dress, or manure of any description, was put upon the land during the whole time of their growth. The season of planting being rather late, and the weather a little unfavourable, the plants looked weakly through the winter, and, compared with that growing in the adjacent fields, and cultivated in the usual way, the appearance was very unpromising; but as soon as the weather became more genial, and the spring advanced, it began to branch out from the root in a very remarkable manner, producing, in many instances, from 18 to 25 luxuriant and healthy stems, and in one case to upwards of 40; and the ground was nearly as much covered as by that sown broad-cast. On the 6th of April, I had the ground carefully measured, and upon counting the plants, found that 33, or about one in 20, had not vegetated, or that had perished during the winter; this reduced the number to 649: these continued to flourish, came into ear in good time, and ripened quite as soon as any wheat in the neighbourhood. The produce on the 34 yards was a little more than four gallons, exclusive of several of the finest plants which I took up with the roots, for the purpose of showing to persons interested in agricultural improvements. One of these, presented to C. S. Dickens, Esq., of Coolhurst, and exhibited by him at the *conversazione* of the Marquis of Northampton to the Fellows of the Royal Society, had 42 ears, all from a single grain. The wheat was of the most excellent quality, and the straw, which stood remarkably well, weighed 72 lbs., or at the rate of 280 trusses to the acre. Taking the 34 yards as the 142d of an acre, the produce, multiplied by 142, would amount to 71 bushels per acre.

This is a garden experiment—my trials also were made in the garden; therefore, no direct farm or field evidence can be derived from them, as to yield on an extensive scale; nevertheless, as the facts are undeniable, we acquire a certain knowledge of the great productiveness of wheat. Many object to the product by tillers; the ears, say they, do not advance simultaneously, and therefore do not ripen at the same time. There is truth in the objection, but the loss sustained by such irregularity (which is found only upon the lowest and last produced laterals, *i. e.* perhaps 2 in 20) by no means neutralises the vast comparative increase. Old habits cleave to us like burrs; and the farmer

of old routine, although he hears of, and actually sees, results, remains in the predicament of the man, who,

> Convinced against his will,
> Is of the same opinion still.

Dibbling is, however, hampered with difficulties, which as yet prevent its general application, and we incline to substitute the *drill;* therefore, it becomes of the utmost importance so to employ that admirable machine, as to secure a return which can approach in prolificity as nearly as possible to that of the dibble.

By using a well-constructed machine drill, besides the saving of seed, the consideration of which is for the present deferred, the grain is deposited most evenly in the ground; but, to obtain all the benefits so derivable, the distances between the rows must be materially increased, in order to admit the free use of the horse and hand hoes. "The use of these removes farther off, if it does not entirely do away with, the necessity for fallowing; and the growing crop is largely benefited by the increase of space, and nourishment afforded from the destruction of the weeds, and by air and moisture given to the roots from the moving of the soil in the rows." If in a drill you deposit either wheat or spring corn in rows only six or seven inches asunder, hoeing and weeding can take place only for a short time and to a very limited extent, because the plants will speedily fill up the intermediate spaces; but if twelve inches be allowed, the several hoes can be brought to bear upon the weeds, often, and at any time, till they are utterly exterminated.

Thus it is with all Mr Davis's fields on the two farms of Haling and Spring Park, near Croydon. I have watched them since the second week of May; and though, as he said, the soil of both is poor, with few exceptions, and the weather so dry as peculiarly to affect gravels and surface chalks, yet all and every crop has been, and is, not only free from intruding plants, which increase aridity and occupy space, but the oats, wheat, and barley, show by their rich dark tint that they find abundance of nutritive matter, in a condition so moist as to maintain them in a state of progressive advance. Proof, therefore, is at hand—convincing and irrefragable—that deep tillage, wide spaces, and frequent movings of the surface, are operations of vital importance, and the practical results of sound theoretic principles.

Thin Sowing.—And here I approach that "vexed question," which has been, and remains, the cause of much controversy. As an impartial observer, one whose great aim it is to discover and diffuse truth, I frankly make the acknowledgment that, as differences in localities are so great as to set aside all prescribed rules, the liberal mind ought to be satisfied with "letting *well*

alone," so far at least as practice may square with the great truth of the poet's line—

That which is best *administered, is best.*

If a certain quantity of seed *do*, in fact, yield an ample and remunerative product—all other circumstances being regulated by a liberal economy—a person should hesitate before he admits of any serious alteration, and so far, particular soils and conditions must influence; but, as a *general principle*, we may safely assume that, as the single seed of grain can, and does, produce hundreds of its like, there must be great and lavish waste ere the produce could be so diminished as scarcely to amount to ten times the quantity of seed usually sown. Let the reader candidly review the statement of facts thus made by Mr Davis. It states that—

There are few persons who seriously take into consideration how small a return is commonly realised from the seed of corn, as at present sown ; and how large a proportion of that return is again swallowed up for seed. Let us take wheat, for instance. The practice throughout England is to sow two and a half or three bushels per acre, and the yield seldom reaches forty bushels, and more commonly less than twenty bushels, so that one-tenth at least of the crop grown is consumed as seed. These facts, contrasted with the knowledge that a single grain of wheat, planted where it has room to tiller out, will readily produce many hundred fold, have induced me, in the course of the last twelve years, to make a variety of experiments, the results of which have clearly shown to me, that, independent of the waste, *a positive and serious injury is done to the crop from sowing so much seed;* and in result is perfectly analogous to attempting to increase the returns of a field by turning four animals on a pasture sufficient to maintain only one ; and, in consequence, I have gradually reduced my proportion of seed wheat from three bushels per acre, which was my practice to sow, down to about three pecks, which reduction I have accomplished, to the very evident improvement of my growth of corn.

This passage appeared in print during the summer of that wonderfully hot and parching summer (or rather spring) of 1844, when scarcely any meadow hay was made; when cattle failed for want of herbage, and in many places were fed on tree leaves, and any green vegetables. I then resided in Berkshire, and witnessed a capital wheat harvest, so far at least as quality was concerned, but, as a set-off, the most tantalising growth of oats and barley, in so much that, in fields known to have been cropped in March and April, a few straggling plants were discernible at midsummer. Some showers fell after that time, and caused more seed to germinate; and thus, with as perfect a summer as ever was produced by a glorious sun, hundreds of acres were all but barren, unfit to be cut; and thus they remained till autumn, here and there a ripe ear among thousands of green and abortive plants, the calamity being mainly ascribable to a deficiency of ground moisture.

I am quite aware that numbers—perhaps the majority of farmers—adhere pertinaciously to the old creed, that "a sparing

of seed is the worst of economy." "Never grudge seed," was the advice handed down from father to son. Having proof positive, and undeniable, before me, of the happy results of a departure from that rule, I am bound to become the advocate of the doctrine which instructs to "try all things;" and, therefore, it may be both safe and advantageous to the reading agriculturist to refer to the authority of Messrs Morton, of Whitfield, in Gloucestershire, who have long adopted comparatively thin sowing—that is, to the extent of 6 pecks of wheat per acre—with the best results, and an average crop of 4½ quarters per acre. The powerful essay from the pen of Mr John C. Morton, addressed to the Royal Agricultural Society, *On the Maintenance of Fertility in New Arable Land*, December 2, 1846, is a document of great interest. It proves that, by wise and skilful management, land, whose gross acreable value in 1836 averaged about 19s., had in 1846 increased to about 44s. 8d. The general principle by which so much improvement has been effected ("after drainage of the land") may be exemplified by the following short extract:—

A field under pasture: pared and burned in the spring of 1840; ploughed, harrowed, and sown to common turnips, of which it yielded a fair crop; in 1841 it bore oats, a crop of about ten quarters per acre; in 1842, it was sown with the white Belgian carrot, and it yielded twenty-two tons per acre of them; in 1843, it yielded forty-two bushels of wheat; in 1844, it yielded a crop of Swedes, not very good, owing to the character of the season; in 1845, the promising plant of wheat which covered it was laid and much injured by the rough weather during August in that year; during the past year, large crops of Italian rye-grass have been cut off it.

The elements of fertility naturally present in the soil ensured the abundance of the first crops—[that is, after drainage, ploughing up of *half* before winter, and paring and burning the other half of pasture early in the spring]—and thus sufficed, free of expense, to start that system of alternate husbandry in full vigour, which, more than any other that can be named, has the merit of self-maintenance. Every other year, for a longer or shorter period since, every field on the farm has borne a crop of wheat; and in the alternate years, the crops have been successively clover, turnips, carrots, clover, mangold, potatoes. The root crops have been for the most part carried to the buildings, and there consumed with, and on the straw, by cattle, sheep, and pigs. The dung thus manufactured is either carried out, as it is made, to the fields on which, during the ensuing year, it will be used—or to stations near the liquid manure tanks, where it may be properly manufactured. About 3000 cubic yards are thus annually applied to the green crops. It is not only made from the consumption of roots and straw, but large quantities of oil-cake, oats, linseed, and beans, are also consumed, and these no doubt add much to its richness. The annual application of so much fertilising matter ensures heavy crops of roots and straw; it insures *that* on which the farmer depends for the re-application each year of an equal quantity of manure. The system thus maintains itself. It was set agoing without much expense; and t contains within itself the elements of permanent establishment.

The foregoing extract will prove how much can be effected by human power, when under the guidance of sound principles. Mr Morton's authority cannot be doubted; nor do I perceive, upon any rational ground, why that of Mr Hewitt Davis should

be questioned. I have now investigated the crops at Haling Park, at several periods between May 10 and the end of July of the present year. A great portion of the farm is little better than pure chalk. A field of oats, of very great extent, slopes steeply to the north. At first, prior to the general rains, it exhibited the plant, in its twelve-inches-apart drills, distant, thin, and to appearance unpromising. In a few days, verdure improved, the rows approached, and thus on the crop went progressing through June, the tint becoming darker, till it assumed a full blue green, clearly distinguishable from that of other fields; so much so as to attract the eye for miles. The tillering was extreme, the stems reed-like, and in July one could scarcely detect the drills. In every part of the ground, the experienced eye could discern a verification of the admirable effect of deep tillage, and of thorough cleaning by the hoe, though it was equally apparent that the best and richest portions of the land carried the finest plants. Next to the oats were field pease, sown in drills, 27 inches asunder. Here, too, the most chalky parts of the field were inferior, while on the deeper loam the plants were rich beyond belief. The hoes (I saw their operations) were repeatedly called into operation, till they could no longer pass; and every where the crop is most abundant. The same may be said of Chevalier barley (with amazingly long ears) sown in November, and of wheat. Turnip-rooted cabbage was transplanted over manure, on ridges about 27 inches asunder, from adjoining seed-beds. And here it may be observed, to the credit of the farmers, that the same system of planting out kohl, and sowing turnips, is widely practised, and is gaining ground. Mr Davis is opposed by prejudice, widely and discreditably; but it is manifest as the sun at noon-day, that his theory and *established* proofs are gaining ground—practically, at any rate, and, to some extent, avowedly. Thus it ever will be with truth!

In order to show, says Mr Davis, that it is not by any artificial aid that I have grown the crops produced on my farms, and in reply to the questions which so often have been put to me, as to what is my practice, I go into the following details:—

My course of cropping is as follows:—

1st year, Rye - - - „ Tares - - -	Used for green meat and feeding off with sheep in April, May, June, and July; and followed by
„ Mangold Wurzel - „ Swedes - - „ Cabbages - - „ Turnips - -	With a liberal dressing of farm-yard manure.
2d year, Oats or Barley -	Sown with clover.
3d year, Clover - -	Twice mown for hay.
4th year, Beans or Pease -	The beans have turnips sown betwixt the rows, which come into feed in September and October.
5th year, Wheat.	

The hay and straw are mostly sold, and therefore the consump-

tion of oil-cake is large. Every crop is drilled, clover and seed excepted: the land is kept perfectly free from weeds; and by the repeated turnings, it not only "receives the benefit of pulverisation and aration," but in all probability grubs and vermin are so disturbed—perhaps destroyed—that their ravages are much prevented. When the routine is once fairly established, "the only dressings given are for the green and root crops, and they are done with the stable dung, or with the manure produced from the consumption (by fattening stock) of the mangold wurzel and half of the swedes, and of the straw and fodder by other stock in the yards, or obtained in exchange for these when sold away."

As I am in the habit, from their proximity, of inspecting Mr Davis's farms, a great part of the land being so bad, gravelly, and ferruginous, as to have induced some of the immense numbers whom curiosity attracts, to say that it is not worth ninepence an acre, I feel impelled to enter somewhat minutely into the nature and course of his routine, especially as the results are so unprecedentedly fine, at a time, too, when complaints of crop are general.

His proportions of seed per acre, and times of sowing, are—

Of Rye	per acre	1½ bushel,	sown	in August.
Tares	„	1½ „	„	in 3 sowings, Aug., Sept., and Oct.
Mangold Wurzel		6 pounds	„	in April.
Swedes	„	1 quart	„	in May.
Turnips	„	1 pound	„	in July.
Cabbages	„	1 every 3 feet	„	in June.
Oats	„	7 pecks	„	in January, February, and March.
Barley	„	6 „	„	in Jan., Feb., March, and April.
Wheat	„	3 „	„	in September and October.
Pease	„	8 „	„	in December, January, and Feb.
Beans	„	8 „	„	in September and Octo

Between the crops, which are sown at intervals of 29 inches, I constantly in the spring keep using the horse-hoes, beginning with those with tines, which break and pulverise the ground, and bring to the surface all root-weeds, replacing the tines with knives, which cut off all on the surface. By the free use of these horse-hoes, by hand-hoeing the narrower sown corn, by drawing all weeds from out of the rows, and by using Finlayson's harrow after the ploughings, I have brought my land without fallowing, and am sure I grow far better swedes and turnips after rye and tares, than I used to do after a fallow, and am much less attacked by the fly (*haltica, the flea-beetle*).

Two remarks here suggest themselves:—*The first*, that beans, according to the table, have turnips sown between the ranks, that is, at somewhat more than a foot from each row of beans. I have closely watched the progress; and early in May of this year, observed that the beans, though firm and green, were scarcely a foot high, and inclined to bloom very shortly. Rain, however, fell very opportunely; the arid ground became free, the turnips were duly sown, and early in July promised well, the beans having grown to double their height, and expanded their flowers.

Not a *haltica* had touched the turnips, nor a black aphis (*dolphin*) the beans. The country rings with sad reports of the ravages of this last named pest: plants of finest growth and promise failed, and now are all but podless; yet, on the 27th and 28th of July, Mr Davis cut and tied up his beans, perfect, and thickly podded; and immediately began to stir the ground, turning in the bean root, there to become manure; and thus, by one operation, bringing to view a complete breadth of turnips standing in ranks with 27-inch intervals. This is one process of high farming, combining luxuriance with economy.

Second, By the unwearying processes of cleansing by the hoes, every weed is exterminated: we can detect none of the grasses, the chickweed, wire-grass, and other rubbish which not only deform and rob our best arable; but, on the contrary, be the weather what it may, the corn, when cut, has no dank weeds to keep it wet, and in field. No time is lost, no danger incurred, and thus we obtain a strong evidence in favour of remote drills.

As a corroborative of the same practice, and, indeed, as the fundamental argument in favour of thin sowing and wide spaces, Mr Davis enters into the following calculation of comparative produce:—

> The yield of an average ear of thick-sown wheat is about thirty grains (*thin* sown yields very much more), and, therefore, as the ordinary return of every acre is at most about thirty bushels, it follows that this quantity, no matter how much has been sown, can at most have only come from the growth of the ears from *one bushel* of seed (and that, too, is allowing only *one* ear to grow from each grain, and thirty grains from an ear). This being the fact, of what use can more seed be, or rather, must it not prove injurious? what becomes of the remaining six or eight pecks, which are commonly sown? And how is the excess of plants thereby produced to be got rid of, without injury to the remainder?

My experiments by the dibble clearly proved that one grain could produce 10 to 15 tillers, each with an ear—some six inches long, and containing more than 60 grains. "A single grain having room, will throw up ten or twelve ears of from sixty to eighty grains, so that, in fact, the yield, were room given to tiller out, instead of thirty for one, which is all a bushel of seed allows, would be many hundred fold; and hence any provision for the loss of seed from vermin or birds is unnecessary, for the deficiency will be met by the tillering and the larger size of the ear which take place wherever room admits of the increase." And I may add, from repeated and present observations, comparing thick and thin sowings, almost in juxtaposition, that the grub or worm makes as many, nay more, and wider spread depredations, among the former than the latter. I saw on the 28th July, in a wheat field of close ill-cleaned drills, vast naked patches—not one plant standing in three-yard spaces—and this divided only by a thorn hedge from a noble plot of thin-sown ten or twelve

inch drills, those intervals being clean as the alleys of a first-rate garden. Your wire-worm and sundry congeners are among the selfish: they stand upon no ceremony, and destroy indiscriminately; hence the thick sower obtains no advantage, and especially when he permits his intervals to be foul, overrun with couch, other grasses and rubbish, whose roots foster the wire-worm. I repeat, that cleanness of tillage, produced by reiterated hoeing, disturbs the grub, and certainly acts remedially; but in pastures, or fields of any kind, wherein the pest has decidedly established itself, nothing but thorough paring and burning to an extent that will carbonise the vegetable matter, can effect a radical cure.

One more reference to the calculations of Mr Davis will suffice, and I shall then refrain from taking further liberties with his article on the "*Waste of Corn*," a little work that has placed truth before the farmer, and left him without excuse, if he neglect to, at least, investigate the evidences adduced by one of the cleverest, and most energetic of cultivators.

The average yearly quantity of wheat and flour imported during the fourteen years ending 1841, was one million two hundred and fifty-four thousand seven hundred and fifty-three quarters. The population of England, Scotland, and Wales, had increased in 1841 to above eighteen millions and a half; but to facilitate calculation, let seventeen millions of persons be assumed as the average during the said period of fourteen years. Then, taking a quarter of wheat as the average allowance for each person, and deducting the quantity annually imported (1,254,753 quarters) from 17,000,000, it will appear that there had been a yearly consumption of fifteen millions seven hundred and forty-five thousand two hundred and sixty seven quarters of wheat of home growth. "Allowing the average per acre of wheat grown in the kingdom to be twenty bushels, which is a high estimate, and that of these, seventeen bushels and a half are appropriated as food, and two bushels and a half for seed, it follows that a mere fraction short of seventeen millions three-fourths quarters must have been annually grown in this country, and that to produce this quantity above seven millions of acres (*i. e.* 7,085,370) must have been sown with wheat. Now, to sow so many acres with two bushels and a half of seed per acre, which is the ordinary allowance, there would be required two millions two hundred and fourteen thousand one hundred and seventy-eight quarters. But to sow the same with one bushel per acre only, eight hundred and eighty-five thousand six hundred and seventy-one quarters would be wanted; so that the annual saving of seed would be one million three hundred and twenty-eight thousand five hundred and seven quarters—that is to say, seventy-three thousand seven hundred and seventy-four quarters more than what has been the average of foreign corn imported during the above period of fourteen years.

The expense of seed-wheat is generally 7s. to 8s. per bushel, and the difference between one and three bushels is therefore 14s. to 16s.—a saving per acre of some consequence; but if, concludes Mr Davis, a *larger* and better crop will be obtained from the lesser quantity, I shall have done a good to the farmer that will do much to enable him to compete with the foreign grower, and lower prices, and to place this country independent of any foreign supply.

I have thus brought my paper nearly to its close, and it remains only to say, that, having during a long course of years observed and publicly reported the condition of husbandry, I can venture to assert, that I consider the system adopted by Messrs Davis and Mechi as pre-eminently sound in principle, and calculated to

lead to greatly improved practice. Without pretending to interfere with minutiæ, and acquiescing in the opinion that "the quantity of seed sown must be regulated by the risks it runs, and on *undrained* soils where much seed will perish during winter, and on land *full of game*, covered with *hedge* rows, where much will be eaten and destroyed, more must be sown" (see editorial remarks, *Agricultural Gazette*, July 31), I contend, that, with *deep laboration*, after draining, so deep as to provide an adequate supply of ground moisture—*wide drills*, so wide as to admit of *thorough hoeing*—*early sowing*, by which much valuable time is gained, and strength of plant insured, and by a wise course of *rotation*, with the liberal application of farm manure to the green or fallow crop—every condition of highly productive farming will be fulfilled. The farms inspected by me have furnished ample proofs of all that can be required: their crops are noble, and altogether superior, at a time and season, when rain is withheld to a degree that has rendered the pasture lands barren and arid as during the continuance of a long winter frost; and when, for want of moisture, the leaves are falling from the trees. The examples thus furnished are equally gratifying and instructive; and as the particular farms are visited daily by numbers of persons of the highest distinction, fully qualified to judge for themselves, we may hope, that, while large allowances must be admitted for local differences, the general principles will gain converts, and be adopted universally throughout the United Kingdom.

DECISIONS IN THE SUPREME COURTS CONNECTED WITH RURAL ECONOMY.

FROM 6TH MARCH TO 16TH JULY 1847.

(Court of Session.)

Entail—Montgomery Act—Application of Compensation for Land taken by a Railway, under the Lands Clauses Consolidation Act.—The Marquis of Bute laid out the sum of L.13,167 : 13 : 6 in improvements upon his entailed estate of Dumfries, in the county of Ayr, under the provisions of the act 10 Geo. III., c. 51, § 9–26 (the Montgomery act), and in terms of the statute obtained a decree to the effect that the heir next entitled to succeed to the estate after himself should be liable, on succeeding, for L.9875 : 15 : 1 (being three-fourths of the sum expended) to his own (Lord Bute's) heirs, executors, or assignees. The Cumnock Extension Branch of the Glasgow, Paisley, Kilmarnock, and Ayr Railway, subsequently passed through the estate, and the Company took nearly 15 acres therefrom, under the powers of their act. For this the sum of L.2000 was agreed to be paid; and it was lodged in the Bank of Scotland, in terms of the provisions of the Lands Clauses Consolidation act.* Lord Bute now applied to the Court of Session for leave to uplift this sum for his own use, in extinction, *pro tanto*, of the debt of L.9875 : 15 : 1 due by the heirs of entail to his own heirs. The Court (Second Division) granted the application, Lord Bute executing a discharge in favour of the heirs of entail to the extent of the L.2000.—*Marquis of Bute*, petitioner, *March* 10, 1847. *Jurist*, vol. xix. p. 414.

Landlord and Tenant—Lease—Arbitration—Obligation to put Houses and Fences in Repair.—George Stevenson sublet the farm of Aberdona, of which he was tenant, in the county of Clackmannan, to David M'Gregor. The latter became bound to pay a grassum of L.500—L.400 in cash at Martinmas 1845 (the term of entry), and L.100 by bill at twelve months. Steven-

* The Lands Clauses Consolidation (Scotland) act, 1845 (8 Vict. c. 19, § 67), enacts—"That the purchase-money or compensation which shall be payable in respect of any lands, or any interest therein, purchased or taken by the promoters of the undertaking, from any 'heir of entail,' or the compensation to be paid for any permanent damage to any such lands, shall, if it amount to or exceed the sum of L.200, the same shall be paid into the bank, to the intent that such monies shall be applied, under the authority of the Court of Session, to some one or more of the following purposes (that is to say)—in the purchase or redemption of the land-tax, or the discharge of any debt or incumbrance affecting the land in respect of which such money shall have been paid, or affecting other lands settled therewith on the same heirs, or for the same trusts or purposes, or affecting succeeding heirs of entail in any such lands, whether imposed and constituted by the entailer, or in virtue of powers given by the entail, or in virtue of powers conferred by any act of Parliament."

son, on the other hand, became bound to put the houses and fences in proper repair, "to the satisfaction of two referees," and to sell to M'Gregor a crop of turnips at the valuation of the same referees. By a minute subjoined to the lease, it was further agreed, that if the referees differed in opinion, they should have power to name an oversman. M'Gregor entered upon the farm, and paid L.400 of the grassum. The referees having differed upon the points submitted to them, appointed an oversman, who fixed a price to be paid for the turnips; and in regard to the repairs on the houses and fences, first obtained the opinion of each referee in writing, and then issued an award, finding a certain sum of money to be requisite to put the houses and fences in repair, and ordaining Stevenson to pay the said sums, and M'Gregor, on receipt thereof, to accept the houses and fences as in the repair required by the terms of the lease. M'Gregor refusing to acquiesce in this award as regarded the houses and fences, two actions were raised by Stevenson to enforce it, and opposite actions were raised by M'Gregor to set it aside. Stevenson maintained that he had done all that was required of him under the lease, and that M'Gregor was bound to implement the counter obligations; while M'Gregor, on the other hand, pleaded, that he was entitled to obtain specific performance of the obligation to put the houses and fences in repair, and that the oversman had exceeded his powers in awarding a money equivalent in lieu thereof. MacGregor further alleged, that the parties were not heard by the oversman. The Court (First Division) unanimously adhering to the Lord Ordinary's (Cuninghame) interlocutor, decided in favour of Stevenson.—*M'Gregor* v. *Stevenson*, *May* 20, 1847. *Jurist*, vol. xix. p. 455.

Landlord and Tenant—Lease granted by Trustees acting under Deed reduced on the ground of Death-bed.—John Macniven, stationer in Edinburgh, on the 27th January 1844, conveyed to trustees his whole property; and on the 24th March thereafter died, leaving a widow, and an only daughter within the age of pupillarity. The trustees entered upon the administration of the estate, and granted a lease of Macniven's shop to his widow, under a declaration, that if, on the death of Macniven's daughter, the heir-at-law should reduce the trust-conveyance on the head of death-bed, the lease, "so far as incumbent on the trustees, should, *eo ipso*, cease and determine." The daughter died on the 30th January 1845, and her uncle, Joseph Macniven, one of the trustees, became heir-at-law. In that character, accordingly, and without being infeft, he raised an action against his co-trustees to set aside the trust-conveyance as having been made on death-bed, and to remove summarily Macniven's widow (now Mrs Murray) from the premises, as having obtained her lease from them.

The fact of the trust-conveyance having been made upon death-bed was not disputed; and the deed was reduced by the Lord Ordinary (Cuninghame) on the 20th March 1846. Mrs Murray, however, contended that the lease to her was still good, chiefly upon the ground that Joseph Macniven was barred from removing her, by having become one of the parties who granted the lease. The Lord Ordinary decerned in favour of the pursuer, but found no expenses due to either party. Mrs Murray reclaimed, and the Court (First Division) adhered unanimously; but, considering that the circumstances afforded grounds for giving some protection to the tenant, they decerned Mrs Murray to remove at the term of Martinmas following, and to account to the pursuer for the rents then due.—*Macniven* v. *Murray*, *May* 25, 1847. *Jurist*, vol. xix. p. 482.

Landlord and Tenant—Lease—Removal of Sub-tenant by principal Tenant.—William Logie occupied a cot-house in the Island of Rousay, Orkney, at a rent of two shillings per annum, and was entered in the landlord's books as having a tack for fourteen years from 1829. In 1839, Malcolm Corsie obtained a nineteen years' lease of the farms of Myers and Nerse, in the Island of Rousay, by a missive, whereby he was appointed to receive the rents of the cottars, and became bound to account for them to the landlord. The missive also contained a special power to Corsie to warn and remove cottars, "upon showing to the proprietor, or any one acting for him, good cause." In March 1843 (just previous to the expiry of Logie's tack), Corsie raised an action of removing against Logie, founded on the Act of Sederunt 1756, in the Sheriff-Court of Orkney, in which decree in absence was pronounced, and Logie was thereafter ejected. In June 1844, Logie raised an action in the Court of Session against Corsie, with the view of reducing the decree of removing, and obtaining damages for the ejection. The chief grounds of action were, that in the summons of removing Logie's cot was wrongly described as situated on the farms of Myers and Nerse; that a principal tenant has no right to pursue a removing, under the Act of Sederunt 1756, against a cottar;* and that there was no evidence that Corsie had shown "good cause to the landlord" for the removal, in terms of the missive. On the other hand, there was no doubt that Logie was one of the cottars for whose rent Corsie was liable, and whom Corsie was empowered to remove; that Logie had paid his rent to Corsie since the commencement of the latter's lease; and that there was no evidence that Corsie had not the land-

* The "Act of Sederunt anent Removings," 14th Dec. 1756, denominates the party entitled to the use of its remedies as "the heritor or other setter of the tack."

lord's consent. The Lord Ordinary (Cuninghame) assoilzied the defender, with expenses; and on Logie's reclaiming, the Court (First Division) unanimously adhered.—*Logie* v. *Corsie*, *June* 3, 1847. *Jurist*, vol. xix. p. 508.

Master and Servant—Wages for service performed—Triennial prescription.—Catherine Lowfoot or Anderson, at or about Martinmas 1836, when she was in her 61st year, went to reside at the house of Andrew Halley, a farmer at Lochend, in Perthshire, to whose wife she was distantly related. She was employed at first in attending upon Halley's wife and four of his children, who were ill of a malignant fever, in the course of which Mrs Halley and one child died. She then went to the house of a married daughter of Halley (on Halley's employment, as she alleged), whose family were also ill of fever, and there she remained two months. Thereafter she returned to Halley's house, and remained there, doing the whole work of an ordinary servant, till February 1843, when she was dismissed without cause. She then raised an action before the Sheriff of Perthshire for six and a half years' wages, from Martinmas 1836 to Whitsunday 1843, at the rate of L.6 per annum, under deduction of certain small sums received at various times from Halley. Halley met this claim by pleading, that Catherine Anderson was received into his house from motives of charity, and without any stipulation as to wages or service; that she was an old woman, unfit for active employment; and that any payments made to her were merely gratuitous. A proof was taken, upon which the Sheriff-Substitute and the Sheriff concurred in assoilzieing Halley from the action. Mrs Anderson, however, advocated the cause to the Court of Session; and the Lord Ordinary (Cuninghame) altered the Sheriff's judgment, by finding that she was entitled to wages, at the rate of L.5 a-year, from Whitsunday 1840 to Whitsunday 1843, under deduction of the partial payments made, but assoilzied Halley from the claim for the prior years, as it had fallen under the triennial prescription applicable to such debts, and had not been supported by the only admissible evidence — the writ or oath of the defender. Halley reclaimed, and the Court (First Division) unanimously adhered to the Lord Ordinary's interlocutor.—*Anderson* v. *Halley*, *June* 11, 1847. *Jurist*, vol. xix. p. 532.

General Turnpike Act—Letting of Tolls—Composition for Public Coaches.—At a roup of toll-bars in the county of Clackmannan, on the 29th April 1845, Archibald Macdonald became tacksman of Causewayhead and Grange toll-bars for one year, from Whitsunday 1845. By the articles of roup it was declared, that the tolls payable for the mail and other stage coaches, &c., already established, were reserved to the trustees, but that "the compo-

sitions for all such carriages to be established after this date, which the trustees reserve right to make, shall be paid to the respective tacksmen, the said compositions not being under 9d. for a two-horse omnibus," &c. Robert Philp and Matthew Barr started a two-horse omnibus on the 23d of May, which passed and re-passed each of Macdonald's toll-bars every lawful day, till the 3d of October, when it was discontinued. The full toll for such a carriage was 1s. 6d. each passage, but no toll was demanded by the tacksman while the omnibus was running. On the 29th November 1845, the road trustees resolved as follows: —"The trustees, considering that, by the articles of set of the tolls for the current year, from Whitsunday last, the right of fixing the compositions for all stage coaches," &c., "to be established during the current year, is reserved to them, do hereby fix the same at 9d. for a two-horse omnibus," &c., "for each time such carriage shall pass or re-pass such bar; and authorise the tacksmen of the respective bars to conform to those charges accordingly." Hereafter Macdonald raised an action before the Sheriff of Stirlingshire against Philp and Barr, for L.69 : 12s., being the full amount exigible, at the rate of 1s. 6d. each toll. Philp and Barr consigned the half of that sum, which they admitted to be due, but resisted payment of the remainder. The Sheriff-Substitute decided in favour of the tacksman, but the Sheriff-Depute reversed his judgment. Macdonald then advocated, his main arguments being, that the trustees' minute of the 29th November was illegal, under the general turnpike act, * and that it neither bore to be retrospective, nor was a fair exercise of the power reserved by the articles of roup. The Lord Ordinary (Robertson) took the same view of the case as the Sheriff-Substitute had done; but Philp and Barr having reclaimed, the Court (Second Division) unanimously decided in their favour, with expenses. †—*Macdonald* v. *Philp and Barr*, *19th June* 1847. *Jurist*, vol. xix. p. 558.

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* The General Turnpike Act (1 and 2 William IV. chap. 43, § 53.), enacts, "That it shall be lawful for the trustees of every turnpike road, previous to letting the tolls, to compound and agree, for any term not exceeding one year at any one time, with any person using such road for the passing of their horses, cattle, or carriages, through any of the toll-bars to be erected on such road, or on the sides thereof, which composition shall be paid in advance; and, in default thereof, the composition or agreement with the person making such default, shall thenceforth be void; and all such composition money shall be paid and applied in such manner as the tolls are directed to be paid and applied: provided, nevertheless, that it shall not be lawful for any tacksman of tolls, or toll-gatherer, to compound with any person for the payment of any tolls, or to accept any lower tolls, than those settled by the trustees of any turnpike road to be taken, or pay back or return any sum of money to persons frequenting any turnpike road, and paying the tolls thereon, with the intent of avoiding the provisions of this act, or of any turnpike act, under a penalty for each such offence, not exceeding L 20."

† The Court held, that the transaction in this case was not a "*composition*" falling

Landlord and Tenant—Lease—Repairs on Mansion-house—Henry Macdowall, Esq. took a lease, by missive, from Hugh Ferrier, Esq. of Clippens, of "the new and old mansion-houses, whole offices, and houses above stables, porter's lodge, lawn, and garden of Clippens," for five years after Whitsunday 1841. By this missive it was provided, that the tenant should get possession of the subjects previous to the term of entry, "to enable him to make repairs and improvements;" and that he should be bound, at his own expense, "to keep the new mansion-house, offices, and porter's lodge, in good and sufficient repair and condition during the lease, and to leave them so" at its termination. Before the expiration of this lease, Mr Ferrier accepted a renunciation from Mr Macdowall, and re-let the subjects to him for his friend John Stirling Napier, Esq., for five years, by a missive, which set forth, that the lease was granted "under the conditions and reservations specified in the missive betwixt" the landlord and Mr Macdowall, the former tenant. Soon after Mr Macdowall's removal, and before Mr Napier took possession, Mr Napier presented a petition to the Sheriff of Renfrewshire, alleging that the buildings were "in a state of great disrepair, and dangerous to occupy," and praying the Sheriff to appoint a qualified party to examine and report upon their condition, and thereafter to decide upon whom lay the obligation of making good the deficiencies. Accordingly, the Sheriff-Substitute remitted to certain tradesmen, who reported, that the joists in the walls of several of the rooms were in an advanced state of decomposition (seemingly from dry-rot); that the rain penetrated in several places, from the slates being defective on the roof; that the lead gutters were also defective, and that in consequence the house was not safe and sufficient. The repairs thus pointed out were effected at a cost of L.55 : 5 : 4, and the Sheriffs Substitute and Depute decided, that this sum fell to be paid by Mr Napier, on the ground that his rights were regulated by the terms of the lease to Mr Macdowall, the original tenant, and that the repairs in question were such as he would have been bound to defray. Mr Napier having advocated the cause, the Lord Ordinary (Wood) made a second remit to the tradesmen, who reported, that the decomposition of the joists must have existed prior to Whitsunday 1841: that any person, with ordinary attention, might have seen that the timbers were materially wrong; that the deficiency in slates was probably of recent occurrence; and that the whole account, except L.13, 16s. 9d. thereof, was incurred in consequence of the decomposition in the timbers: and his Lordship then pronounced an interlocutor, ad-

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properly under the 53d clause of the General Act, but was rather a *variation* or *abatement of tolls*, in terms of the stipulation in the articles of roup, and fairly prised in the power reserved."

hering to the Sheriff's judgment. Mr Napier reclaimed, and the Court (First Division) unanimously found Mr Ferrier, the landlord, bound to defray the expense incurred on account of the decomposition of the timbers in the mansion-house of Clippens, "in consequence of the unsafe state thereof at the period of Mr Napier's entering," with modified expenses.—*Napier* v. *Ferrier*, *24th June* 1847. *Jurist*, vol. xix. p. 586.

Montgomery Act—Repairs on Mansion-house of Entailed Estate.— The late Earl of Kintore, being the heir in possession of the entailed estates of Keith-hall and Kinkell, executed certain repairs upon the mansion-house of the property, under the Montgomery act (10 Geo. III. c. 51). The late Earl having died, his executors under the provision of the above statute, brought an action against the present Earl of Kintore, as the next succeeding heir of entail, for payment of three-fourths of the amount expended upon these repairs. His lordship objected to certain parts of this claim, on the ground that the proper vouchers and evidence of the particulars of the expenditure had not been recorded, in terms of the statute. The document recorded by the late Earl bore to be an "account of expenditure by the Right Hon. Anthony Earl of Kintore, on the repairs of the mansion-house and offices of Keith-hall," &c.; and to it was subjoined a declaration signed by the late Earl, certifying that it was "a true and correct account of the expenditure," "which I do now lodge along with the vouchers thereof," &c. The entries in the account related to the builder, glazier, plumber, and other work respectively, and were all similar in form to the following:—"Cash paid Alex. Smith, builder, £50," and the voucher corresponding to each entry was a stamped receipt in the form following:—"Received from Lord Kintore £50, to 'account of expenses of wright, for the repairs of the mansion-house and offices at Keith-hall.'" The present Earl contended, that these documents should have enumerated "the particulars of the materials, and of the workmanship." There was also an item of L.100 for ironmongery, which was objected to, on the ground that the voucher did not show that it was employed on fixtures for the mansion-house. The Lord Ordinary (Murray) reported the case to the Court (First Division), and they unanimously held, that the late Earl had sufficiently complied with the statutory requirements,* and accordingly decerned for

* The statute directs that entail proprietors who mean to avail themselves of its provisions, "shall, annually, during the making of such improvements, within the space of four months after the term of Martinmas, lodge with the sheriff or steward-clerk of the county within which the lands and heritages improved are situated, an account of the money expended by him in such improvements during twelve months preceding that term of Martinmas, subscribed by him, with the vouchers by which the account is to be supported when payment shall be demanded or sued for." 10 Geo. III. c. 51, § 12.

payment of the claim, but without finding expenses due to either party.—*Morrison and Others* v. *Earl of Kintore, 30th June* 1847. *Jurist*, vol. xix. p. 614.

Servitude of Pasturage over a Commonty—Possession for Seven Years.—The estate of Duchall originally belonged to one proprietor; but at the death of the late Alexander Porterfield, the entailed portion of the property descended to James Corbet Porterfield, and the unentailed land became vested in Mr Pearson. Attached to the estate was the muir or common of Duchall, which effeired *pro indiviso* to both the entailed and unentailed portions. Pending a judicial division of this common, Pearson sold a portion of the unentailed land to Mr M'Millan, including "a right of servitude of pasturage for six score of sheep, and for five queys, in that part of the muir of Duchall which shall be given to the unentailed lands of Duchall, upon the division of the said muir being completed." M'Millan accordingly exercised this right of servitude for more than seven years, when Mr Porterfield (the process of division being still in dependence) applied for an interdict against his continuing to do so, on the ground (1) that M'Millan's title only gave him a right of servitude after the division of the muir was completed; and (2) that while the muir was joint property, neither proprietor could create a servitude over it without the consent of the other. The Lord Ordinary (Robertson), disregarding these pleas, refused to grant the interdict *hoc statu*, and on a reclaiming note, the Court (First Division) adhered unanimously to his decision.—*Porterfield* v. *M'Millan, 3d July* 1847. *Jurist*, vol. xix. p. 627.

Salmon Fishing—Breach of Interdict.—In 1846, Lord Gray and others, proprietors of salmon-fishings in the river Tay, obtained an interdict against William Petrie, at that time tacksman of Randerstone-dyke, a fishing station lower down the river than their fishings; by which he was prohibited from "fishing within the river or estuary of Tay," otherwise than "by net and coble." Subsequently, the same parties presented a petition and complaint against Petrie for breach of this interdict, in respect that he had, in May 1847, at the fishing stations of Seaside and Clarksdyke (also below the complainers' property), used fixed machinery for catching salmon. Petrie denied the acts complained of; and, further, contended, that although the words of the interdict were general, it was intended to apply only to Randerstone-dyke; moreover, the complainers had not produced their title. The Court (First Division), unanimously repelled these pleas, and remitted to the Sheriff of Perth to report as to the facts of the

alleged breach of interdict.—*Gray and Others* v. *Petrie*, *6th July* 1847. *Jurist*, vol. xix. p. 630.

Landlord and Tenant—Tacit Relocation—Damages for Miscropping and Deterioration of Buildings.—James Hall purchased the estate of Killean, in Argyleshire, with entry at Whitsunday 1837, and an assignation to the rents of that, and all succeeding years. Archibald M'Gill was tenant of a mill and certain lands on this estate, under a written lease, which expired, as to the houses, &c., at Whitsunday 1837, and, as to the arable land, at the separation of the crop of that year. This lease contained stipulations binding the tenant to cultivate the farm by certain rules, and to uphold and leave the houses and mill in good order. M'Gill was not removed at the expiry of this lease, but continued to possess the subjects by tacit relocation for two years later. He was, however, removed, by warning and decreet, from the houses, &c., at Whitsunday 1839, and from the arable land at the separation of the crop. On the 18th May 1839, the landlord sequestrated for his rent, and, on the 7th September, he presented a petition to the Sheriff of Argyle, praying for the appointment of inspectors to report whether the tenant had contravened the conditions of the lease, and what damage had been thereby incurred, and for decerniture against the tenant for the sums which might be reported as due. The Sheriff obtained the reports of inspectors, which fully supported the allegations as to miscropping the land, and the bad state of the buildings, and valued the damage sustained thereby. The Sheriff thereafter having decided against the landlord's claim, Mr Hall advocated the cause to the Court of Session. The chief argument on behalf of the tenant was, that Mr Hall, having only become proprietor of the estate at Whitsunday 1837, when the lease expired, had obtained no right thereto, and that the tenant's possession for two years after that date was not to be regulated by the terms of the written lease. The Lord Ordinary (Cuninghame), however, found damages due to the landlord, in terms of the inspectors' report (about L.44). M'Gill reclaimed; and then, for the first time, put forward a plea, that the summary mode of procedure adopted in the Sheriff Court was incompetent, and that a regular action of damages should have been raised. The Court (Second Division) unanimously repelled this plea, and, upon the merits, found the sum of L.32 due to the landlord, with interest and expenses. —*Hall* v. *M'Gill*, 14*th July* 1847. *Jurist*, vol. xix., p. 650.

(House of Lords.)

Schoolmaster.—Power of Dismissal.—Andrew Weir was in 1820 appointed, *ad vitam aut culpam*, English teacher in the

Lcademy of Kilmarnock. This academy was founded in 1806 by he heritors of the parish and the magistrates of the burgh, who or this purpose merged into one institution the then existing arochial and burghal schools. In 1811, the constitution of the cademy was fixed by a set of resolutions, which declared that its overnment should be vested in certain parties as directors, who hould exercise the patronage of the institution, should appoint he teachers, enact regulations, &c.; and that the teachers should e bound to observe the regulations. The only innovation upon his constitution appears to have been an alteration in the qualiications of directors, which was made in 1828. Mr Weir acted s teacher in the academy, without complaint, till January 1844, vhen certain reports injurious to his character having arisen, a neeting of directors was held upon the subject. Mr Weir was reviously informed by letter of this meeting, and of the charges gainst him; and a note requesting his attendance was dispatched o him from the meeting. In reply, Mr Weir sent a note declinng to attend, or to hold any verbal communication on the subject. :n these circumstances, a committee was appointed to investigate he rumours afloat against Mr Weir, which they did (but not in the resence of Mr W. or of any one on his behalf); and they subnitted a report to a subsequent meeting of directors, to the effect hat Mr Weir had been guilty of very great breaches of trust, as collector of a widows' fund, and as agent for an insurance company, and was disqualified from retaining his appointment as eacher. This report was communicated to Mr Weir, with a request that he should attend the meeting. Mr Weir having accordingly appeared, the report was read over to him; and, after the subject had been discussed for some time, the meeting was adjourned, in order that he might make up his mind as to what course he would adopt. At the adjourned meeting Mr Weir offered to resign, on certain conditions, which were not agreed to. Thereafter a written statement of the charges was served upon Mr Weir, in reply to which he wrote a letter, generally denying the charges, but objecting to the right of the directors to investigate his conduct except as a teacher, and substantially refusing to enter upon his defence. He subsequently wrote, appealing to the commiseration of the directors, and promising good behaviour in future; but this not being deemed satisfactory, the directors proceeded, upon the 22d April 1844, to depose him from his office. Mr Weir upon this presented a note of suspension and interdict against Mr Crawfurd and the other directors. The Lord Ordinary (Robertson) reported the case to the Court (Second Division), who directed his lordship to refuse the note. Mr Weir appealed to the House of Lords against this judgment, pleading, that being possessed of the status of a parochial school-

master, he had not been accused before or convicted by a competent tribunal; and that, irrespective of this, the proceedings against him were irregular and unjust. The House of Lords, however, affirmed the interlocutor of the Court of Session, the judges being of opinion that Mr Weir was not in the position of a parochial schoolmaster, and that, apart from the original charges against him, he was liable to removal for refusing to submit his conduct to the investigation of the directors.—*Weir* v. *Crawfurd*, 14*th June* 1847. *Jurist*, vol. xix. p. 568.

Landlord and Tenant—Liferent Lease—Removal—Expiration of Lease.—In 1759 the late Marquis of Tweeddale let the farm of Corsbie, in the county of Berwick, to the late James Murray, for the space of three 19 years and the lifetime of the said James Murray; and, in case of his death before the expiry of the third 19 years, for the lifetime of his heir who should be in possession at the end of the said third 19 years. The entry to the farm was declared to be Whitsunday 1759, "to be peaceably possessed, laboured, and manured by the said James Murray or his heirs, secluding assignees, during the haill time and space above mentioned." The lease further declared, that "James Murray, and his heirs and successors whatsomever, are hereby bound to flit and remove themselves, cottars, servants, and subtenants, the Whitsunday next immediately after the expiration of their tack, without any warning or process of removing to be used for that effect." James Murray died before the expiration of the third 19 years, and was succeeded by John Murray as heir, who, surviving the third period of 19 years, continued to possess the farm under the above lease, as liferent tenant, till his death. This event happened upon the 8th of March 1845; and thereafter, Dr John Murray, his son, and his other representatives, proceeding to plough up, and being about to sow, certain portions of the farm, the Marquis of Tweeddale and his commissioners presented a note of suspension and interdict against their doing so, on the ground that the lease, and the right of exclusive possession conferred by it, wholly terminated with the death of the liferent tenant, and that the clause as to removing at Whitsunday only bore reference to the occupation of the houses. The question came to be of importance from the consequent right of reaping the way-going crop. The Lord Ordinary (Ivory) granted the interdict, but the Court (First Division), with the exception of Lord Fullerton, took an opposite view of the case. An appeal, however, being taken, the House of Lords concurred in the opinion of the Lord Ordinary, and reversed the decision of the Court of Session.—*Marquis of Tweeddale and Others* v. *Murray and Others*, 22*d June* 1847. *Jurist*, vol. xix. p. 572.

TABLE OF PRICES, &c.

The Average Price of the different kinds of GRAIN, per Imperial Qu following Markets :—

LONDON.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
1847.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
une 5.	102	0	49	0	31	7	66	3	68	10	56	10
12.	95	6	51	8	33	1	65	4	58	10	55	8
19.	93	7	51	2	31	11	64	2	58	4	54	10
26.	94	4	50	5	28	7	63	8	57	5	52	4
uly 3.	90	8	49	11	28	9	62	10	57	4	50	7
10.	86	1	40	4	28	3	61	4	55	11	50	9
17.	78	3	41	1	23	6	60	0	53	4	49	0
24.	76	0	39	3	25	8	56	8	51	6	46	6
31.	80	5	39	2	31	0	55	2	56	0	48	11
ug. 7.	78	10	37	7	28	3	42	4	50	8	49	3
14.	67	2	38	6	23	8	35	0	44	8	52	5
21.	64	0	39	7	29	6	35	10	41	0	49	8
28.	64	10	40	1	27	10	36	2	38	9	48	2

EDIN[BURGH]

Date.	Wheat.		Bar
1847.	s.	d.	s.
June 2.	80	11	50
9.	88	8	53
16.	84	9	52
23.	83	2	51
30.	73	5	46
July 7.	70	10	43
14.	75	7	45
21.	75	8	43
28.	71	9	43
Aug. 4.	66	10	41
11.	64	10	34
18.	62	1	36
25.	56	10	32

LIVERPOOL.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
1847.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
une 5.	86	2	51	9	45	7	68	6	66	8	64	0
12.	84	10	49	4	42	6	69	4	65	9	56	4
19.	85	9	46	8	45	2	72	0	64	10	59	0
26.	80	2	48	6	39	5	74	8	58	6	51	6
uly 3.	78	11	50	2	36	10	70	6	59	4	50	9
10.	74	4	45	11	35	1	66	4	57	2	46	3
17.	70	3	44	8	30	7	60	2	54	4	53	4
24.	66	0	43	4	29	8	58	8	50	6	52	6
31.	66	7	42	6	31	9	50	4	53	6	61	3
ug. 7.	62	0	37	5	29	8	45	8	50	9	54	4
14.	58	0	32	6	30	8	40	2	45	10	55	6
21.	58	10	27	7	30	0	36	6	42	4	54	6
28.	51	8	30	2	28	1	35	10	40	2	54	0

DU[BLIN]

Date.	Wheat, p. barl. 20 st.		Barl p. ba 10 s
1847.	s.	d.	s.
June 4.	51	4	28
11.	50	4	27
18.	49	11	27
25.	49	2	27
July 2.	46	7	26
9.	43	7	25
16.	42	0	24
23.	40	8	24
30.	38	8	23
Aug. 6.	36	4	20
13.	36	8	18
20.	27	2	16
27.	29	0	15

[T]ABLE showing the Weekly Average Price of GRAIN, made up in terms [of] ... IV., c. 58, and 5th Vict., c. 14, and the Aggregate Averages which regul[ate] ... able on FOREIGN CORN : the duties payable thereon, from June to S[eptember]

[Dat]e.	Wheat. Weekly Average.		Wheat. Aggreg. Average.		Wheat. Duty.	Barley. Weekly Average.		Barley. Aggreg. Average.		Barley. Duty.	Oats. Weekly Average.		Oats. Aggreg. Average.		Oats. Duty.	Rye. Weekly Average.		Rye. Aggreg. Average.		Rye. Duty.	Pe[ase]. Weekly Average.		Aggreg.
[184]7.	s.	d.	s.	d.	Free	s.	d.	s.	d.	Free.	s.	d.	s.	d.	Free.	s.	d.	s.	d.	Free	s.	d.	s.
5.	99	10	90	7	...	55	3	53	5	...	35	11	33	7	...	72	0	64	7	...	61	8	57
12.	88	10	92	2	...	52	0	53	10	...	34	1	34	2	...	67	0	66	6	...	59	1	58
19.	91	7	93	9	...	52	1	54	0	...	33	9	34	6	...	76	11	69	8	...	56	10	58
26.	91	4	94	10	...	52	4	54	0	...	32	11	34	6	...	64	11	70	8	...	57	0	59
3.	87	1	93	6	...	51	11	53	4	...	32	10	34	4	...	65	0	70	0	...	56	8	58
10.	82	3	90	2	...	48	8	52	0	...	31	11	33	7	...	61	9	67	11	...	55	10	57
17.	74	0	85	10	...	46	1	50	8	...	29	7	32	6	...	67	9	67	3	...	53	8	56
24.	75	6	83	8	...	45	8	49	7	...	30	5	31	11	...	59	1	65	11	...	53	0	55
31.	77	3	81	3	...	45	3	48	6	...	31	1	31	6	...	57	1	62	7	...	46	6	53
7.	75	5	78	7	...	43	11	47	1	...	31	1	31	2	...	52	2	60	6	...	47	5	52
14.	66	10	75	3	...	40	7	45	2	...	29	1	30	6	...	40	2	56	4	...	42	10	49
21.	62	6	71	11	...	38	11	43	7	...	28	9	30	0	...	35	5	51	11	...	40	4	47
28.	60	4	69	8	...	37	9	42	0	...	27	4	29	7	...	34	7	46	5	...	39	11	45

PRICES OF BUTCHER-MEAT.

Date.	LONDON. Per Stone of 14 lb.		LIVERPOOL. Per Stone of 14 lb.		NEWCASTLE. Per Stone of 14 lb.		EDINBURGH. Per Stone of 14 lb.		GLASGO[W] Per Stone of
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	M[utton.]
1847.										
June	7/6 to 8/3	7/9 to 8/9	7/3 to 8/	7/3 to 8/	6/6 to 7/6	6/9 to 7/6	6/6 to 7/6	6/9 to 7/9	7/3 to 8/3	7/6
July	7/9 8/6	7/9 8/9	7/6 8/3	7/6 8/3	6/9 7/9	6/9 8/	6/6 7/9	7/ 8/	7/6 8/6	7/
Aug.	8/ 9/	8/ 9/6	7/9 9/	7/9 8/9	7/ 8/	7/3 8/3	7/ 8/	7/6 8/6	7/9 8/9	8/

PRICES of English and Scotch WOOL.

English, per 14lbs.

Merino,	12/6 to	16/
in grease,	9/	13/
South Down,	12/	16/
Half Bred,	10/	14/
Leicester Hogg,	12/	16/
Ewe and Hogg,	8/	14/
Locks,	6/	8/
Moor,	5/	7/

Scotch, per 14lbs.

Leicester Hogg,	12/ to	16/
Ewe and Hogg,	9/	14/
Cheviot, white,	8/	12/
Laid, washed	6/	9/
unwashed,	5/	8/
Moor, white,	5/	7/
Laid, washed,	4/	6/
unwashed,	3/	5/

FIARS.—CROP 1846.

DUMFRIES.

Wheat per im. qr.	78s.	0d.	Pease, no evidence.		
Barley	39s.	0d.	Beans	57s.	4d.
Bear	38s.	6d.	Rye	43s.	4d.
Oats, Potato	32s.	0d.	Malt	80s.	0d.
„ White	31s.	6d.	Oatmeal per 140 lbs.	25s.	5d.

BUTE.

Wheat	61s.	10d.	Oats	31s.	8½d.
Barley	38s.	6d.	Beans, no evidence.		
Bear	34s.	0½d.	Oatmeal per 140 lbs.	26s.	6d.

THE REVENUE.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Qua[r]ters and Years ended on the 5th of July 1846 and 5th of July 1847—show[-]ing the Increase and Decrease on each head thereof.

	Quarters ending July 5.		Increase.	Decrease.	Years ending July 5.		Increase.	Decrease.
	1846.	1847.			1846.	1847.		
	L.	L.	L.	L.	L.	L.	L.	L.
Customs	4,523,391	4,519,119	...	4,272	17,688,461	18,792,348	1,103,887	...
Excise	3,104,711	3,291,052	186,341	...	12,025,112	12,733,998	708,886	...
Stamps	1,730,495	1,869,461	138,963	...	6,988,940	7,201,797	212,857	...
Taxes	2,006,427	2,075,001	68,574	...	4,229,899	4,325,732	95,833	...
Post-Office	181,000	215,000	34,000	...	794,000	854,000	60,000	...
Miscellaneous	18,001	7,461	...	10,540	193,237	307,621	114,384	...
Property Tax	1,000,162	1,036,517	27,355	...	5,183,912	5,491,936	308,024	...
	12,564,187	13,013,614	455,233	14,812	47,103,561	49,707,432	2,603,871	
	Deduct decrease on the quarter		14,812		Deduct decrease on the year			
	Increase on the qr.		440,421		Increase on the year		2,603,871	

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1847.							
June	Danzig	87/ to 93/	52/ to 56/	30/ to 40/	45/ to 52/	56/ to 66/	48/ to 56/
July	...	60/ 72/	44/ 52/	28/ 36/	30/6 36/	42/ 48/	46/ 54/6
Aug.	...	46/ 54/	30/ 36/	26/ 30/	28/ 32/	38/ 44/	46/ 50/
June	Hamburg	78/ 86/	45/ 53/	26/6 31/6	38/ 46/	65/ 70/	45/ 51/6
July	...	70/ 80/	40/ 47/	22/6 27/	30/ 35/	60/ 67/	40/ 46/
Aug.	...	50/ 60/	28/ 32/6	18/ 22/	24/ 28/	50/ 56/	38/ 44/
June	Bremen	75/ 84/	48/ 54/	28/ 36/	42/ 50/	58/ 68/	49/ 57/
July	...	62/ 70/	42/ 48/	24/ 30/	32/ 38/	45/ 50/	46/ 54/
Aug.	...	45/ 52/	30/ 35/	18/ 21/6	29/ 33/	40/ 46/	42/ 47/
June	Konigsberg	66/ 78/	50/ 55/	27/6 35/	42/ 48/	54/ 63/	50/ 58/
July	...	65/ 72/	41/6 46/	20/ 24/6	34/ 37/6	46/6 54/	45/ 52/6
Aug.	...	45/ 55/	28/6 34/	16/6 20/6	30/ 34/	43/ 50/	42/6 48/

Freights from the Baltic have declined from 8/ to 4/; and from the Mediterranean from 13/6 to 8/6. per qr.

THE LABOURING CLASSES.

We are about to comment upon some eloquent remarks recently addressed to the editor of a provincial journal in Normandy, by M. Charpentier, *avocat*, which, if they are founded on true principles, have far more force of application to Great Britain than to France, where the extremes of wealth and indigence are much less broadly distinguished.

No effective impulse was given in France to agriculture, commerce, and manufactures, until about twenty-five years ago. The cry has, however, been already raised in that country, that the number of her poor is fearfully augmenting, and that pauperism is progressing in an inverse ratio with the increase of her national wealth, even though millions of human beings are employed in her husbandry and trade.

It is strange to our apprehension that any theorist should maintain the proposition that the increase of national or individual wealth should not benefit the working classes in any country. We are surprised at encountering theorists who assert that though the rich man may profit largely by the judicious application of his ingenuity and capital, and realise all that ambition and the most luxurious tastes can desire, the labouring people employed by him, through whose industry his wealth is progressively increased, do not advance in their condition. Now, we are far from denying that the condition of the labouring classes does not advance *pari passu*, nor even at any very perceptible rate of progress, with that of the colossal capitalists of our times; but there is no reason for jumping to the conclusion that the social system is radically and incurably wrong, which facilitates the indefinite increase of oligarchical and national wealth in the aggregate, and that no very beneficial results accrue to the working classes, which are the main producers of that wealth. It is going an extravagant length to say, that "since wealth has gone entirely to one side, and misery to the other, the system which has engendered such abuse has already received its death-blow, that its existence is only an affair of time, since it bears with it the seeds of its own destruction." M. Charpentier complains, also, that though private charities were never so liberally bestowed in France as at this day, when asylums for the destitute, savings-banks, lotteries, concerts, and bazaars, are common, and regular contributions made from the inhabitants of towns, and voluntary assessments to give food, clothing, and employment, the number of poor is greater than it was twenty-five years ago, when no such charities prevailed. This may possibly be true; but as the assertion is not proved by reference to statistic tables in the letter

before us, we cannot assume the truth of his position. Nay, we have grounds for contradicting it.

The town in which M. Charpentier lives, affords some evidence of the incorrectness of his notion. Thirty years ago, when the population was 5000, the number of *beggars* going from house to house was not less than 300: they received alms in the streets; and so annoying were they to the inhabitants generally, that many charitable individuals appointed certain days for giving to each of those mendicants two *liards*, half a *sou*, on the condition that they were not to be called upon on other days. There were then no buildings in progress, no masons, carpenters, labourers, except in comparatively few cases; and besides those professional beggars, there were no doubt several distressed householders, too proud to beg, and yet without the adequate means of subsistence. The population of the same town amounts now to 8000 persons; whole streets have been built; various town improvements have taken place in a degree astonishing to the inhabitants themselves; *capital* has increased among the gentry and the shopkeepers; and one of the results of the accumulation of funds is, that mendicity no longer exists in the town. Though there is no legislative provision by compulsion for the support of the poor, the wealth of the nobility, the gentry, domestic and foreign, and of the people in business, provides means for giving constant employment, and consequently food and clothing, for all the inhabitants who require it, in a present population of 8000 souls.*

Could the necessities of the poor be thus provided for—employment systematically and continuously afforded in various

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* Contrasting with the extravagance of expenditure so notorious in many instances in Great Britain and Ireland, without producing corresponding benefits to the poor, the last report of the receipts and disbursements for aiding labourers, and supporting the absolutely destitute, may be interesting to the reader.

Receipts.	Francs.	Disbursements.	Francs.
Benevolent fund,	6,799	Bread,	16,455
Voluntary subscriptions,	13,412	Fuel,	1,178
Donations in poor-boxes,	1,761	Lodgings,	1,000
Proceeds of charity ball,	367	Medicines,	755
Concert	426	Linen and clothing,	2,143
Lottery,	3,280	Apprenticing	486
Sale of a pianoforte	310	Aid to sick and infirm,	452
Produce of men's labour,	847	Nursing five children,	492
Women's do.	858	Men's charity workshop,	4,569
Church collections,	1,150	Women's do	4,703
Poor funds,	5,300	Money loans,	903
Repayment of money lent,	295		
			33,136
	34,805		

The town in question is, however, a model town in every particular, and not an illustration of municipal economy and management in general through France.

works, whether of necessity or embellishment, unless the superior grades possessed capital; and the superfluities of that capital are continually issuing forth in the erection of new houses, new promenades, new workshops, all tending to provide the means of living to the increasing population of workmen whose families are in an especial manner benefited by the free schools which national and individual funds provided for them, even to a very advanced state of education for boys, if they have the time, the talents, and the desire to profit by the facilities within their reach, *prima facie* it might be expected, that, accordingly as the amount of productions and the general wealth of any country increase, the number of poor will diminish. Yet the contrary is the fact. The cause of this, however, is not to be found in the increasing wealth of capitalists, but in the numerical increase of the labouring population beyond the demand for labour which progressive wealth and luxury create.

That the increase of individual or national wealth (for they are in fact convertible terms) tends of itself to the extension of pauperism, we deny altogether, as we dispute the kindred proposition, viz. that the condition of the poor is not ameliorated, generally, by the increase of wealth of a country, or of the individuals who represent it.

Let us suppose two countries, one rich, the other poor, but equal in area and population. The condition of the labourers in the rich country will be better than that of the labourers in the other, because the capitalist in the former will employ them either in necessary and productive works, or in supplying those artificial wants and tastes, which a country highly civilised requires.

We take England and Ireland for examples (irrespectively of the recent famine), the one wealthy, the other poor; and we cannot fail to perceive, that, notwithstanding their acknowledged wants, the English poor are better fed, better clothed, and better housed, than the analogous class in Ireland.

This difference arises from the greater wealth of England, considered as to her land proprietors and commercial men. In England (including parts of North Britain too) merchants and manufacturers realising fresh capital, find wants and desires continually springing up, which multiply the demands for labour both in town and country; while in Ireland—with exceptions certainly—labourers may stand all day idle in the market-places, because no man has need of them. In which country are the labourers best paid, best fed and clothed? The reply is, obviously, in the richer country—*there* will be the greatest demand for labour of every kind; and with that demand, wages and comforts must increase also.

Even the good soil of the poor country will not produce as much food as the poor soil of the other, because there will be less capital and skill expended on it.

France is an instance of this. The poverty, the want of skill, energy, and enterprise of the petty proprietors—those little farmers who are often no better off than the common labourers of our country, and (the crowning origin of the backwardness which French agriculture exhibits) the infinite subdivision of land in France, co-operate in diminishing the productiveness of the soil to a great degree. A British farmer, with an unfavourable soil, will extract more wheat from it, if his season be not adverse, than the Norman farmer will draw from his rich loam.

Labourers, by a necessary reaction, will not obtain, whether in cash payments or in the productions of the soil on which their labour is expended, the same amount of remuneration which they would receive if their labour were more productive to their employers. The proprietors of land, or the large tenant-farmer who counts his rotations by fifties or hundreds of acres, may surely be expected, indirectly, to aid and better the condition of his work-people (though he will not raise the rates of wages without necessity) when his profits exceed the ordinary range, and his capital increases. Steady employment for them will be the consequence of his own success—with alternating losses, employment must fluctuate also, or cease with the diminution of his capital: and the emigration of the labourers in search of subsistence elsewhere, be the ultimate result. Would the peasantry of Skibbereen have starved if they had been in the neighbourhood of even half a dozen of the capitalists of Manchester, residing in their country seats, or directing the movements of a mill? Would they have suffered any of the horrors we read of, if a Coke, a Bedford or Buccleuch, a Morgan or a Boyse, a Downshire or a Fitzwilliam, had been the lord of their soil? No: the oligarchical wealth which M. Charpentier so deprecates, would have proved the means of obviating the possibility of such calamities as have overwhelmed the human live-stock of a poor and petty proprietary, whether of the aristocratic or commercial grades.

We happen to recollect the locality and general circumstances of one gigantic flour-mill in the county of Carlow, and would stake our lives—without having had one word of direct information on the subject—that the proprietor of that mill did not suffer any of his labouring families, whether employed in it or on the improvement of his land-estate adjoining, to feel the want of a single meal during the famine period. But could he have done so, without possessing a considerable portion of that oligarchical wealth which M. Charpentier thinks so useless to the poor, under the present system of its application?

The soil bears a strict analogy to the articles used in commerce and trades, inasmuch as it is the raw material from which agricultural produce—such as corn—is manufactured. We shall therefore indifferently take our illustrations from agriculture and trade. Let us suppose, then, a wealthy land improver to set about draining, enclosing, and planting a large extent of land. He procures a great number of workmen, and provides many of them with cottages; affords to those of them who possess cows the privilege of pasturing them in his woods or on his moors; and pays to them and their wives and children, when employed, the highest rates of wages given in his neighbourhood. He continues for years his works of improvement—throwing down old fences, making new ones—cutting off springs which had formed quagmires—thorough-draining his clay soils; raising stones and breaking them for farm and other roads; embanking a river which previously overflowed his meadows; planting trees, which in twenty years become highly valuable; raising limestone from quarries; building lime-kilns; manufacturing draining-tiles; making new roads, which give facilities to the labouring poor to reach their churches and chapels, their schools, markets, and corn-mills; causing wheat to flourish, where only oats or rye had grown before; reclaiming a moor which had been almost barren; and, finally, after expending much capital in such manufacture of the rugged soil, this benefactor to his country increases his rental and realises a new capital, which may yield him on further application a very high per centage.

Can it be reasonably argued that the labourer is not benefited by this system of outlay, which multiplies the capital of his employer, and adds to the national resources? Is not the labourer directly and positively benefited by the constant employment which he and his family have received during the progress of such works, and the accumulation eventually of capital in the hands of his spirited and philanthropical employer? Besides, are there not many collateral and indirect advantages—small prizes we may call them—of which the industrious and intelligent labourer has some probabilities? If he can write and keep accounts, and is of approved honesty, skilful, and industrious, he has a reasonable chance of being raised from the grade of hewers of wood and stone to that of an overseer of other labourers.

The writer of these remarks can furnish a case in point from his own experience:—He at one period of his life ventured to reclaim a tract of moorland; and having occasion to employ three quarrymen and lime-burners, was so much struck by the peculiar industry, shrewdness, honesty, and temperance of one of them, that he soon made him a sort of bailiff over the other workmen

employed on the moor. He built for him a house on the reclaimed land, and advanced him money to buy a small cow That man, by the unceasing labour of himself and his children, was soon able to keep a second cow, and at length became the tenant of one of the reclaimed lots, containing about thirty statute acres; received a per-centage for collecting rents from the other tenants, and died possessed of half-a-dozen cows, besides having given a fortune of £15 with each of his daughters, and left his widow and youngest son in possession of the mountain farm. The children of steady and intelligent workmen are frequently apprenticed, as a reward for good conduct, to masters who teach them their respective trades—thus they may become carpenters, wheelwrights, masons, smiths, gardeners. This is a decided elevation for them from their original grade, arising from the prosperous condition, more or less, of their employers.

Here is a plain and common instance of benefit arising to the working classes from the increasing prosperity of their superiors.

Again—if the national funds of a country be flourishing, there will be a larger amount of *public works*, giving more chances of those small prizes to which we have alluded, than if the treasury be deficient in funds for making roads, piers, harbours, railways, embankments, and other works, by which multitudes of human beings obtain not only the means of living, but the opportunities of rising to a higher station in the social scale.

The arguments of M. Charpentier, and those who coincide in opinion with him, may perhaps be more clearly considered by a reference to the operatives under the manufacturing system—properly so called. He says, that though the profits on the capitals of the manufacturing oligarchy may rise indefinitely, the subordinate operatives have no increase of wages and comforts in consequence; and that the more the present state of things progresses, the more will the capitalists, who turn their capital in every way, accumulate in their own hands the wealth of the nation to which they belong, to the loss of the small proprietary class of farmers and labourers in general. And he farther says, that the incorporation of great companies will overthrow and destroy small and individual speculators, causing the great majority to live in absolute dependence, while the minority forms a monied and industrial oligarchy. And to sum up the list of evil consequences to be dreaded, he asserts that the more the monopolists shall find themselves powerful and independent, the more will they reduce the wages of their workmen, who will be obliged to submit to the reduction in order to live, else crimes and public executions will multiply, which will light a general conflagration at some period more or less distant. We see, he adds, that the

present system of the division of the profits of production, as it now subsists between the capitalist and the workman, necessarily brings in its train disorders which begin to manifest themselves. It will be vain to attempt relief—compassion will be ineffective—experience will show that the farther the system proceeds, the greater will be the distress, and the more odious the inequality which exists between the two classes become. To attempt to fill up this gulf with eleemosynary contributions, would be to undertake the labours of the Danaïdes. While he prognosticates social ruin, he does not give us any practical information, nor satisfactory suggestions, as to remedial measures. He shows us the disease, but cannot cure it.

Many both in our own country and in France claim for every man a *right* to be supported by his labour, and that right they would secure to those who have no property, in the usual acceptation of the term. The friends of the people demand higher rates of wages for them; they call for a distribution of payment on other principles than those which prevail at present; they would give the labourers, by some improved legislation, immediate and direct advantages beyond food and clothing; they would settle matters so that they might realise something from the factory against a reverse of trade, which, under existing circumstances, may render the operatives engaged in it a swarm of paupers, while their employers may have retired from speculation and work at a lucky hour, with fortunes realised by their labour.

M. Charpentier's notion of what might be done, is connected in his mind with the spirit of the 1853d article of the civil code of France. That he conceives to have been framed with a prospective view to the case of a man desirous of contributing his labour to any given work for a share of the profits which might arise from it. If such a person should be asked what share he expects in the undertaking, or what profits or losses, when they are undetermined by any special rules, he answers that his share ought to be equal to that of the shareholder who has contributed the least money capital.

M. Charpentier argues, that in any productive labour there is a tacit contract between the capitalist and the labourer, and that they ought to regulate their mutual relations by the principle of societies, and give the workman a fixed share in the profits of production. But if this were acted on in manufactures, the labourer ought also to bear his share of the losses, which, as he is not a money capitalist, and lives only by his daily earnings, he could not possibly do. The inequity of such a hypothetical arrangement is manifest. The value of skilled labour and intellectual power, such as the capitalist is supposed to bring to his undertaking, is of incalculably more importance than the physical

power or manual dexterity of the common workman; and, admitting for a moment that M. Charpentier's notion were practicable and in operation, what would be the probable result? There must be a committee of management, each member of which—the pauper shareholders, perhaps, especially—would interfere with the plans of the company, and the "most sweet voices" of the moneyless partners would be heard above those of the principals. In short, there would be an inquisitorial influence at work—delegates would insist on examining books and witnesses—there would be spies over the judicious speculations of much wiser men, whose private intentions would become public, and therefore liable to counteraction, to the obvious injury of the interests of the company concerned. Such a *principle* may be acted on in parts of North America, where labour is enormously dear—where land, the raw material of North American industry, costs but little—where there is hardly a money medium—where the poor man is almost as useful as the rich one—where the local circumstances afford a sufficiency of food, fuel, and clothing, the great necessaries of human life—*there*, or in any primitive country, where manual labour and skill are at a high premium, the system of working the soil on shares may be excellent; but as civilisation and populousness progress, such a system of partnership must cease. It is an acknowledged difficulty to reconcile the *right* to be supported by labour with the rights of property. This is one of the most serious problems of modern times, and it is one of most vital interest to the most numerous class of human beings. England in fact admitted the principle in the 43d Elizabeth, and in acts of the last session of Parliament, and remarkably so as respects Ireland, where the opportunities of living by their labour were supplied by the Administration to the poor on a gigantic scale, which could not have been laid down, if the accumulation of wealth by England, nationally and individually, had not been enormous. And this fact, too, is an answer to the original position which it is our object to disprove. Whether the poor have an inherent right to be supported by their labour, or whether such support should be granted on the principles of brotherly love, of moral and religious duty, or from motives of self-interest and self preservation, is beside the question at issue. The effect as regards the labourer is practically the same. If he be employed steadily, at a rate of wages suited to the cost of food, from whatever causes or motives the impulse may be given, he will be bettered in his condition, or *vice versâ*. Consistently with the rights of property, how can the wages of labour be regulated by any other *principles* than those under which the labour system is conducted?

Would to God we could see any equitable and practical mode

by which the condition of the labourer may be improved in respect of wages!

We shall assume, in the case of a cotton-mill owner, that he is a man of common sense,

> Who knows what's what, and that's as high
> As metaphysic wit doth fly,

if not constitutionally philanthropical. His own interest, if he be influenced by no higher motive, will suggest to him, that, if he is not an actual loser by so doing, it is better for him to have his mill at work than idle, for the double purpose of affording employment and subsistence to the operatives dependent upon him, and of preventing any derangement of the machinery from disuse.

If he would keep a large body of labourers in a state of readiness for work, and within call, his interest will prevent him from leaving them in a discontented and impoverished state. It is, indeed, possible that he may be so selfish as to calculate on their necessities for a supply of cheap labour, when he chooses to employ them—

> He may throw off his *men* as a huntsman his pack,
> For he thinks, when he will, he may whistle them back;

but can he be certain of their disposition to come at his whistle? Workmen sometimes combine, and turn out for higher wages than their employers think fit to pay; therefore, it will be more for the advantage of the latter to be kind and liberal to their operatives at all times.

We may fairly conclude, that, either from benevolent or prudential considerations, the great mill-owners, and other capitalists in trade, will endeavour to provide the means of employment for their operatives. They will work their machinery on the chances that some demand will spring up for their manufactured goods, even when the market is overstocked and heavy. Mr Fielden has stated instances of this kind, and even of some loss voluntarily sustained by manufacturers, to keep their work-people from idleness, and we have no reason to question the veracity of his assertion. Yet, as a matter of prudence and of general fact, mills will not be kept going, nor work of any sort persevered in, if there be no profit from them.

Factory labourers are often reduced to extreme want, from the inability of the master manufacturers to employ them, or from their insolvency; and the condition of such workmen must, in the nature of things, depend on the ability of the capitalists to employ them. The alternations of the workmen, in the scales of prosperity and adversity, must turn on the same balance that

regulates the rise or fall in the value of the articles produced by their labour.

We have held to the affirmation, that the condition of farm labourers, whose wages are usually fixed, is improved by the accumulation of wealth in the hands of their employers; and we maintain the same with respect to factory labourers, whose wages are not fixed, but must necessarily fluctuate from the nature of trade. To them, too, the increase of capital among their employers is likely to be of immediate advantage; for no body of men possesses more intelligence, more capacity for calculation, more shrewdness, than the manufacturers of all grades. They estimate exactly what the profits are on every piece of goods sent forth from their factories; and they rarely fail to demand and receive a proportional rate of wages. Having the right of working or not as they may choose, they can make their bargains; and they are quite ready enough to strike, and injure the mill-owners, if they conceive they are inequitably dealt with. They know that, on a colossal scale, a farthing per yard of extra profit would yield a great surplus to their employers, and they calculate to the fraction the advance which ought to be made to them in consequence.

Indeed, the greater danger, where large masses of men are concerned, who know their power, is, that the employers may be overwhelmed, than that the employed shall be inadequately paid.

The low condition of the labourer does not proceed from any injustice in the labour system. It seems, in truth, to be the design of Providence that there shall be very low as well as very high degrees among men; and our Saviour has expressly said, "the poor ye have always with you;" and according to the progress of civilisation in any country, are the degrees of elevated and lowly stations, of good and evil, learning and ignorance, skill and stupidity, wealth and poverty.

There are great and little prizes in the lottery of life, but there are few, comparatively, very fortunate drawers; yet there are many who have obtained reasonably good prizes. Now, let us inquire, what did those prize-holders originally put into the lottery? Skill, industry, education, perseverance, and capital more or less; in a few cases, but very few, no money capital whatever. Is it not reasonable and just that they should have a high reward? It is no injustice to the community that a great number should not have obtained the same successful results. Instances enough might be adduced to prove, that many individuals have reached a high station by their skill, intelligence, and probity. The Almighty bestows his gifts as he pleases. Men born among the lowest of the people, earthen vessels in the potter's hands, dare not say to their Maker, Why hast thou made me thus?

They may, however, be designed to fill noble parts on the stage of life; and they ought to be contented with the conviction, that there is no absolute impediment in the existing order of things, to their rising from the humblest station to one of affluence and respectability.

The capitalist who has acquired much wealth by the work of his brains and great industry, has a right to be considered by his operatives as entitled to a share of profits immeasurably greater than that to which the self-styled friends of the people would consider them entitled. They would divide the lion's share among the multitude of animals, which, if they had the power of doing, would not permanently improve their condition.

If capital became minutely subdivided, what would become of the great mills? Must there not always be a large capital afloat to meet the exigencies of the market, to employ extra labour, and purchase the materials of the trade at the most advantageous time, and to hold over goods from the market when it is overstocked? By the system which enables the capitalist to augment wealth beyond that which he first employs, the means of supplying fresh capital for new enterprises, and for the requirements of increasing population, are multiplied. While the labourer sleeps soundly, without dread of bankruptcy, and the cares and anxieties which accompany even successful trade, his master may be agitated in mind. Oppressed by the sense of heavy responsibilities, his brain is worked, and the wear and tear of that have terrible effects on human life.

In England, where the supposed evil of oligarchical wealth prevails so much, there is a counterbalancing desire to ameliorate the condition of the working classes; and that desire is daily assuming the legitimate character of duty: grievous ills are acknowledged by men of all parties to exist, but their removal, so peremptorily demanded by the voice of the times, is in progress, as far as human precautions can effect the object.

Legislative enactments and voluntary efforts are not wanting. In cities, narrow streets are thrown open; houses are purchased for the purpose of being cleared away, to admit a freer course of ventilation; sewers are being constructed to carry off the noxious matter which otherwise would be the cause of disease to the crowded families of labourers; wash-houses provided for the promotion of cleanliness and health, and promenades for exercise and recreation.

In Birkenhead, for one example, commodious buildings for workmen have been erected, and their comforts have been especial objects of national and individual anxiety in that locality. Artisans and inferior workmen used generally to live, and still unhappily do live, in numerous instances, in the close and dila-

pidated habitations of preceding generations, which successively took flight in search of purer air and more cheerful abodes, suited to their wealthier condition. Confined courts, undrained, unventilated, are still occupied here and there, nests of poverty, starvation, and disease; but acts of Parliament, with sanitary care, and municipal regulations, are every day removing nuisances of this nature.

The public purse has never been so freely opened for the promotion of the comforts of the poor as now. Can any one deny that there is a vast amount of advantage conferred upon the poor, by the union houses, the admirably organised hospitals, and infirmaries and dispensaries throughout Great Britain and Ireland? Is it not a great benefit for them to receive gratuitously the best medical treatment, food and lodging, and every thing which their condition may require? Can it be denied that charitable institutions, public and private, are continually increasing? Reference might be made to the numerous alms-houses which charitable individuals have provided for the relief of the poor. Considerable portions of land have been allotted by public grants and individual philanthropy for cottage gardens, which have preeminently improved the condition of the labourer in town and country.

One would think that some of our modern theorists had never heard of the miserable condition of our population in by-gone times, and that they had been living upon cakes and ale, *à discretion*, until modern times. But what says the author of the Survey of Inverness-shire? "Before the culture of potatoes became so extensive, I have known that their fathers and grandfathers were urged by necessity to bleed the cattle occasionally, when their pittance of meal was expended; and having afterwards boiled this blood, until it became solid, they ate it for bread with the milk of their cows. No such necessity prevails at present."

In the great manufacturing cities, we know that while work is brisk, the quantities of white bread, butter, meat, beer, tea, sugar, and cheese consumed by the working people, is enormous; and it is from their want of prudence and economy, and neglect to save for a day of scarcity, that much of their periodical distress is attributable.

We would remind M. Charpentier, that in 1823, when the oligarchy of wealth in France was inconsiderable compared with the present day, there were in Paris alone 61,500 paupers supported in charitable institutions, and 64,000 in their own houses, besides a vast amount of unknown private charities, and yet that the streets, quays, and all public places, were filled with mendicants. Such was the extent of pauperism, a quarter of a century ago, in the metropolis of France, in a population of 713,936 souls. At

present the population is about 900,000; and the number of poor, as returned by the bureaus of the twelve arrondissements, is not greater—we believe it to be less—than at the former period. If we want examples of the extent of pauperism in countries where *capitalists* do not abound, we have only to turn our eyes to Spain, Portugal, and Italy, where misery and mendicity are on a gigantic scale—where "beggars are as regular in their attendance at the door as the landlord or waiter, and place themselves in positions to catch the eye, turn which way you will, making a monotonous buzz, like a distant swarm of bees." "Naples," says another writer, "is crowded with beggars; cripples of all sorts hold up their stump of a leg or an arm close to our eyes: noseless faces, devoured by disease, grin at us: children quite naked, nay, even men, are to be seen lying and moaning in the dirt: a dropsical man sits by the wall, and shows us his monstrous belly: consumptive mothers lie by the road side, with naked children in their laps, who are compelled to be continually crying aloud. Even in our dwellings we are not free from the painful spectacle."

The contrast between Ireland now, when her population exceeds eight millions, and the year 1672, when it only amounted to one million three hundred thousand, is another illustration of our opinion, as opposed to that of M. Charpentier. Their habitations were "lamentable wretched cabins, such as themselves could make in three or four days, not worth five shillings the building; out of the 200,000 houses, 160,000 are wretched cabins, without chimney, window, or door-shut, even worse than those of the savages of America; their food consisteth of cakes, whereof a penny serves for each week; potatoes from August to May." From 1724 to 1772, repeated famines occurred, though the highest amount of population did not then exceed two millions and a half. With more than three times that population now, the number of diseases and deaths is considerably fewer in proportion, and the food, clothing, and habitations of the labouring classes, are considerably improved—all owing to the increasing civilisation and aggregate wealth of the country; and employment is daily becoming a more certain good, and an assured pledge of the future diminution of pauperism and its evils.

If the land proprietary and commercial classes were not capitalists to a great extent, would it be possible for them to bear the pressure of taxation of various kinds, which the pauperism of the many has imposed upon them? What would have been the result to the hordes of famished labourers which have inundated the British shores, if, instead of accumulated capital among the commercial oligarchy, there had been an equalisation of property among them?—a case which precludes the very notion of wealth. It has been by the combined application of public funds and in-

dividual capital that the multitudes of Irish poor which rushed for food to the parish managers of our great emporiums of wealth, have been fed; they must otherwise have perished by tens of thousands.

The condition of the labouring classes in Ireland, if they were faithful to their own interests, might be greatly advanced in the present day by themselves. The field of remunerating employment opened for them is immense. And in that country the combination of capital in companies, which M. Charpentier thinks so destructive of private enterprise, is actually working a great amount of good wherever the system is in operation.

The Irish Waste Land Company, who are effecting what individuals have not the means of doing, purchase land, reclaim it, add to the productiveness of the island, give employment to the labourer, and the opportunities of becoming a small tenant farmer, acquiring independence and capital, where he had been previously struggling with wretchedness and poverty. We like the system of joint-stock companies. The combination of small funds creates active and diffusive capital—diffusive of good—yet accumulative constantly of the means of doing good.

What does M. Charpentier think of the results which have flowed to England from the chartered company which, with shares of £50, became the mighty instrument of obtaining the mastery over India? What might not the French company at Orient have effected for France, if they could have retained the influence in India which they had for a time? The principle of companies is the most useful imaginable. But it is time to conclude. We attempt not to doubt the existence of an enormous amount of social evils among the labouring poor, and an extreme inequality between the upper and lower classes; but we do not admit that the misery we complain of, and with which we sympathise most sincerely, is attributable to the accumulation of national or individual wealth. The cause is to be found in the excess of labour above the demand for it; and the surest means of alleviating the poverty of the labourers, are to be looked for in the increasing wealth of the employing classes.

It is unquestionably a melancholy consideration—as we walk through some wide and wealthy street admiring the rows of glittering shops—that there are in the near vicinity of those gorgeous houses where wealth and luxury seem paramount, ill-fed, ill-clothed, and over-worked children of labour; but, on the other hand, the money issues from those splendid edifices which affords an asylum to the poor man in his destitution—which provides him, in his extremity, with food and clothing and lodging far above his condition, if he chooses to accept the boon.

It is from those great houses that much of the funds proceed,

which give to the labourer the means of living. From them issue the contributions, also, which tend to elevate his moral state—to enlarge the accommodation which he needs in church or chapel, where the poor have the gospel preached to them; and to provide the education which may render his children more prosperous than himself. The church itself being unable, except in a very partial degree, to supply the moral wants of the poor, societies have been formed for the purposes of building, repairing, and enlarging churches, the chief object being free sittings, and of supporting and endowing schools and societies! Are these not ministers of charity and good? Whichever way we look, the condition of the labourer, both in England and France, is improving, and will improve, we trust, in a higher ratio, through the very channels which M. Charpentier and similar theorists consider to be the conductors of social misery.

Much remains, however, to be done. The claims of the labourer we desire to see acknowledged in the utmost latitude that his case will admit of, and every attention paid to his wants which justice, a sense of duty, and of self-interest we may add, imperatively demand from all those whom Providence has blessed with the power of promoting such object.

D.

LEGISLATIVE MEASURES OF THE LATE SESSION RELATIVE TO THE CORN TRADE, AGRICULTURAL AFFAIRS, AND RURAL IMPROVEMENT.

In preparing the following analysis of the various measures passed during the late Parliamentary Session, in regard to agricultural affairs, particular attention has been paid to the preservation of the spirit of the respective acts, and to render their object and tendency more intelligible to the general reader, by divesting, as much as possible, the leading provisions of their legal surplusage.

Foreign Corn Trade.

There were four acts passed during the late session, giving legislative sanction to the importation of foreign corn, &c., duty free, for certain specified periods, "by reason," as expressed in the preambles, "of the partial failure of certain crops usually forming part of the subsistence of the people of these islands." The very first measure to which the royal assent was accorded (January 26) was an act declaring "that no duties of customs shall be chargeable upon any corn, grain, meal, or flour already

imported, or hereafter to be imported, into the United Kingdom, or the Isle of Man, from parts beyond the seas, and entered for home consumption, until the 1st of September in this present year."

The second act (which received the royal assent the same day as the preceding) refers to the Navigation Laws, and enacts, that from the passing of the act until the 1st of September 1847, corn, maize, grain, flour, meal, rice, or potatoes, the growth or produce of any country, "may be imported into the United Kingdom for home use in vessels of any country." Another provision of the act declares, that any such grain that may have been warehoused for "exportation only," may be entered for "home consumption."

The third act was passed on the 23d of February, and suspended, until the 1st of September 1847, the customs duties on the importation of buck-wheat, buck-wheat meal, maize or Indian corn, Indian corn meal, and rice.

On the 8th of June, Mr Bankes referred to a notice that stood for that evening (and which other business, he said, would prevent coming on), touching a further suspension of the import duties; whereupon the Premier intimated that he intended, on an early day, to propose, in a committee of the whole House, that the duties on the importation of corn should be suspended till the 1st of March 1848. Accordingly, on the 10th of June, a resolution to this effect was introduced and agreed to by the House, and a bill founded thereon brought in, which received the royal assent on the 9th of July. In this act (cap. 64) we find, in addition to the articles particularised in the preceding statutes, "certain other articles" enumerated as admissible for home consumption, free of duty—viz. rice meal, barley (pot or hulled), mandioca flour, and ship biscuit or biscuit of other kinds not being fancy biscuit or confectionery.

It was pending a discussion on this last measure that the member for Dorsetshire (Mr Bankes) inquired whether the government proposed to review the laws relating to the weight of bread, as the public (he said) had, during the many fluctuations which had taken place the previous ten months in the prices of corn, been very great sufferers from the absence of a proper control over the weight and price of bread—that article never following the prices of corn. Lord John Russell, in reply, said it was not intended to introduce any measure for regulating the assize of bread. He also added, that he was convinced very great waste occurred from the consumption of new bread before a certain number of hours had elapsed after it had been baked; nevertheless, he did not think it desirable to introduce any bill which it would not be practicable to enforce.

Breweries and Distilleries.

With a view to the obviating an anticipated pressure on the grain markets, in respect to the demand for barley, in the beginning of the year, two bills were brought in by her Majesty's ministers, one for the purpose of permitting the use of sugar in the brewing of beer; the other "to further encourage the distillation of spirits from sugar in the United Kingdom." Both these measures (caps. 5 and 6) received the royal assent on the 23d of February, despite the formidable opposition that was raised against them. None of the evils apprehended by the barley growers have, however, arisen from the operation of the statutes in question; and so far from either brewers or distillers being averse from the substitution of sugar for barley, a recent official return notifies, that from the passing of the acts in February, to the 5th of July last, 3,477,453 lbs. of sugar were actually used by licensed brewers in the United Kingdom; and as much as 11,419 cwt. were taken into stock by distillers during the same period—the quantity actually conveyed to the mash-tun being 10,026 cwt., and the quantity of proof spirits made therefrom 105,165 gallons. Both acts are without a limitation clause.

Rural Improvement—Drainage.

Among the other measures to which the attention of the legislature was addressed in connexion with agricultural affairs, we find no less than six acts passed to advance that important department of rural improvement—the drainage of lands. Of these, one applies to Great Britain generally; one to England and Wales; three to Ireland; and one exclusively to Scotland.

The first (cap. 11), which received the royal assent on the 30th of March, is entitled "An act to explain and amend the act authorising the advance of money for the improvement of land by drainage in Great Britain." The act which this statute purports to amend, was passed in the previous session, having for its object the facilitating works of drainage by advances of public money to a limited amount, on the security of land to be improved. The measure was based on the assumption that the productiveness of a considerable portion of land in the United Kingdom was capable of being greatly increased by drainage; and that by the operation of which a further benefit would be accomplished in the additional employment given to agricultural labour, and the sanitary improvement imparted to the respective localities. By the act in question, the sum of three millions (two for Great Britain and one for Ireland), was authorised to be advanced out of the consolidated fund, in the shape of a rent-charge at the rate of six and a half per cent per annum, for 22 years. The provisions of the act, however, being strictly confined to works of *drainage only,*

the applications for advances for "Great Britain" did not absorb more than one-half of the available amount; while those for "Ireland" were of a totally insignificant character. For instance: the number of applications on the part of English occupiers was 48—the aggregate sum required, L.211,843; that for Scotland, 168—the amount, L.803,804; while in Ireland, out of 28 applications, representing a sum under L.40,000, only *three* were entertained, and those for L.9140. The paucity of applications from the sister kingdom, and the rejection of nearly all those that were made, arose from the peculiar holdings of the applicants, and the objectionable nature of the tenure—there being, it seems, nearly two millions of acres of cultivable land in Ireland held in joint tenancy on the old pastoral system.

The professed object of the act of 1846 having been to a certain extent nullified by the restriction to which we have alluded, it was deemed expedient to enlarge its provisions, by authorising the application of laws to the execution of certain other specified works. Accordingly, with a view to this desideratum, a bill was prepared by Sir George Grey and the Lord-Advocate (brought in on the 2d of March, and received the royal assent on the 30th), declaring the following expenses to be deemed and included as among the expenses of works of drainage in respect of which advances might be made, viz.—

1. The expense of making, or improving, and securing from, or for the benefit of, the land proposed to be improved by drainage, an outfall through other land, or such part as the Commissioners may think reasonable, of the expense of making, or improving, and securing such outfall, for the benefit of the land in respect of which the advance may be applied for, and of other land.

2. The expense of making open drains and water-courses, including such open drains and water-courses as may need frequent repair, where reasonable security for their maintenance shall appear to the Commissioners to be afforded by the interests, or liabilities, of the tenants and occupiers of the land; and

3. The expense of fencing, trenching, and clearing the surface of land to be drained, for the purpose of converting the same from waste, or pasture, into arable or tillage land, where such fencing, trenching, and clearing respectively, shall appear to the Commissioners to be necessary to secure, and render productive, the proposed improvement by drainage.

Provided always, that it shall appear to the Commissioners that in all the cases aforesaid, the works will effect an improvement in the "yearly value of the land" which will exceed the utmost yearly amount which can be charged thereon under the said act, in respect of the advance applied for.

All works undertaken through the assistance of advances are, by another clause, required to be completed within five years; but no application for a larger sum than L.10,000 would be entertained from the same owner, unless it could be shown, to the satisfaction of the Commissioners, that the works might be completed within three years; "and that it shall also appear that such works are to be executed within any district in Scotland in which distress prevails, and that such works may be executed by

he labour of the inhabitants of such district;" in such case the Commissioners would exercise their discretion as to the propriety of advancing a larger sum.

Greatly beneficial as this last act was considered over its predecessor of 1846, it was nevertheless deemed decidedly objectionable as regarded its intended operation in Scotland, inasmuch as all questions that might arise under its provisions were to be submitted to the adjudication of a board of Commissioners in London. Among the foremost in representing to the Commissioners the inconvenience that would ensue from not having a local machinery to carry out the measure in its full efficiency, were the directors of the Highland and Agricultural Society of Scotland, through whose prompt interference a separate bill, replete with enactments available to all cases that may occur within Scotland, was prepared by the Lord-Advocate, Mr Duncan M'Neill, and the Earl of Lincoln, and which received the royal assent on the 23d of July.

This statute (cap. 113) is entitled "An act to facilitate the drainage of lands in Scotland;" the preamble to which states, *inter alia*, that it is expedient to render the said recited acts [*i. e.* the two to which we have been referring] more operative and effectual, and to facilitate and promote the drainage of lands in Scotland, by making provision for the improvemant of outfalls, &c. The act contains eighteen clauses; and as some of them are most important, and to which it may be occasionally useful to refer, we give them in substance.

The first clause enacts that persons desirous of improving their lands by drainage, but who may be unable to execute such works "by reason of the objection, absence, or disability of any person whose land would be entered upon," may make application to the sheriff of the county in which such land may be situate, or where the lands are situated in more counties than one, then to the sheriff of the other county or counties. A map or plan of the land required to be entered upon, cut through, or interfered with, must also be annexed to the application; which said map must also further specify—

The rivers, water-courses, ditches, and drains intended to be cleared, scoured, deepened, or embanked, and the proposed variations, divisions, abridgements, or enlargements of the same, and the new cuts, embankments, drains, water-courses, and other works proposed to be made, and the dams, sluices, weirs, or floodgates, to be lowered, altered, or removed, and the engines and machinery proposed to be erected for the purposes of such drainage or improvement; and also schedules showing the reputed proprietors, lessees, and occupiers of lands proposed to be drained and improved, and the lands and property required to be entered upon, cut through, or interfered with respectively, for the purposes of such drainage or improvement, and also an estimate of the expense of the proposed works, engines, and machinery, including the probable amount of money payable as purchase and compensation money, in respect of the land and property or rights required to be entered upon, cut through, interfered with, or affected,

and also a statement of the actual condition of the lands proposed to be drained or improved, and of the probable increased value of the land consequent upon the execution of the proposed works . . . Copies of the said application, map, schedules, estimates, and statements to be deposited in a place appointed by the sheriff, within or near the parishes to which such application shall relate, and to be open for public inspection for one month: copies or extracts to be furnished to any persons requiring and paying for the same.

The second clause enacts, that "the clauses of the land clauses consolidation (Scotland) act, 1845, with respect to the service of notices on owners and occupiers of land, shall be incorporated with this act; and that notice, as therein provided, shall be given of such application having been presented." Parties affected by the proposed works, are required to notify their objections in writing to the sheriff "not sooner than six weeks, and not later than eight weeks, from such publication." The next clause empowers the sheriff to require security for the costs of inquiries in relation to applications. The fourth clause refers to the examining and hearing of objections, and invests the sheriff with power to appoint a properly qualified person to inspect the lands proposed to be drained or improved, and to report thereon to him; all persons interested in such inquiry are also required to appear before the sheriff at some place within the parish of such contemplated improvement, on receiving twenty-one days' notice. The next clause empowers the sheriff to authorise the execution of the works within a time to be limited, if satisfied that the proposed drainage may be effected "without material detriment to the lands, or property, or rights proposed to be entered upon." The sixth clause declares, that in the case of objections lodged before the sheriff, the expenses attending the proceedings which may take place in consequence of such objections, shall be borne by the persons by whom the application is made, unless the sheriff shall decide that any objection is frivolous or vexatious; in which case the sheriff may award such part of the expenses as he shall think just, to be paid by the objector.

The two following clauses are important. The first refers to works that may be executed, and enacts—

That it shall be lawful for any person authorised by the sheriff to enter upon any land specified in the order of the sheriff, to widen, straighten, deepen, divert, scour, or cleanse any river, stream, ditch, drain, brook, pool, or water-course, and to make, open, and cut any new water-course, side-cut, ditch, or drain, and to make or erect any bank, dam, weir, sluice, floodgate, ditch, drain, tunnel, or other works necessary or convenient for drainage, and to erect and maintain on such lands, steam and other engines and machinery: Provided always, that nothing herein contained shall interfere with or be held to supersede the present law authorising and regulating the cleaning, scouring, and maintaining of streams and water-courses throughout their whole length, by the different proprietors thereon, according to their respective rights and interests therein, and for recovering the expenses thereby incurred.

The next clause relates to obstructions on rivers, &c. that may be removed by order of the sheriff. It enacts,

That where the drainage outfall of any lands is prevented or obstructed by the damming up of any river or stream, by any weir, dam, sluice, or other obstruction, it shall be lawful for any person, authorised by the sheriff, to enter in and upon the lands where such weir, dam, &c. is situated, and to remove, alter, lower, or otherwise interfere with the same, or with the water-courses connected therewith, as shall be necessary or convenient for the purposes of the outfall: Provided always, that where such weir, dam, &c. is for the use of any factory or bleachwork, or of any mill other than a corn-mill, thrashing-mill, or saw-mill, or of any factory or bleachwork, it shall not be lawful to diminish the working water-power of such factory or bleachwork, or of such mill, without the consent of the owner or occupier thereof.

The remaining clauses may be briefly narrated. The tenth clause refers to the protection of fisheries, mills, and houses; no obstruction in any river or stream to be removed, where necessary, nor any steam-engine to be erected upon the bank of any river, to the annoyance of any dwelling-house, without the consent of the parties, and full compensation. Neither are any ornamental waters to be diverted or affected without the consent in writing of the several proprietors thereof; nor is any entry to be made on lands until compensation for the damage is agreed upon. The thirteenth clause authorises the incorporation with this act of all the provisions of the lands clauses consolidation (Scotland) act of 1845, "in so far as the same are not inconsistent;" to which is added this proviso: "That in estimating the amount of any compensation to be paid as aforesaid, it shall be lawful to take into account the benefit which, in consequence of the operations authorised to be executed, may accrue to the party claiming compensation, or to the lands, property, or rights proposed to be interfered with or affected." The next clause empowers the sheriff, on the application of any person interested, to give authority to enter from time to time upon all lands where works have been executed, and to perform such operations as may be necessary for maintaining, repairing, and upholding the same in an efficient state; the expense of such operations to be proportionally allocated by the sheriff among the persons deriving benefit therefrom. Two copies of every order of the sheriff authorising works to be executed, to be made and deposited, one copy with the sheriff-clerk of the county where the drainage takes place, to be kept among the records of the county; the other to be deposited with the parish schoolmaster for the time being in the respective locality; all persons interested therein, to be permitted to have access to the same, and be furnished with copies or extracts on payment of two shillings and sixpence for inspection, and after the rate of threepence for every seventy-two words of any copy or extract. The concluding clause forbids the construction, altering, or extending on the shore of the sea, or of any creek, bay, or arm of the sea, or any navigable river communicating therewith, where and so far up the same as the tide flows,

any work which might not have been lawfully constructed in case this act had not been passed, without the previous consent of the Admiralty. A similar interdiction extends against the construction of any work affecting the internal navigation of the country without the consent of the trustees and proprietors of the property, and of the Commissioners of Woods and Forests.

Such is the sum and substance of the act passed on the 23d of July last; and that it is regarded by landowners as a statute especially calculated to "facilitate" the drainage of lands north of the Tweed, may be collected from the fact, that four days after it had received the royal assent, we find no less than seventy-two applications notified in the *London Gazette* for loans on the part of Scotch proprietors for the purposes of drainage—the aggregate amount being L.189,165.

The next statute (cap. 38) which falls to be noticed—and which received the royal assent on the 21st of June—is entitled, "An act to facilitate the drainage of lands in England and Wales." The principal object of this measure is to enable persons having land requiring drainage or other improvement, and who may be prevented from carrying out their designs "by reason of the objection or disability of any person whose land would be entered upon, cut through, or interfered with," to apply by memorial to the Inclosure Commissioners, who are authorised by the preamble clause to carry this act into execution, showing the means by which such land may be drained, and annexing a map or plan of the same description of the land and property required to be acted upon; these matters being deemed satisfactory, the Commissioners may authorise the execution of the works, compensation being first made to the proprietors for any damage occasioned by such entry.

In the general enactments of this act, there is little variation from the preceding one. The principal distinctions are—the appointment of the "Inclosure Commissioners" in place of sheriffs of counties; an "assistant commissioner" to inspect all lands proposed to be drained; and the depositing of copies of memorials, maps, plans, &c., "in such convenient place or places as the Commissioners shall approve, within or near the parish or one of the parishes in which the land to which such application shall relate shall be situate, there to remain open for public inspection for a period of one month." Copies or extracts to be supplied to parties requiring them, on payment for making the same.

The next act (cap. 79) which received the royal assent on the 22d of July, in one of the three pertaining to the sister kingdom, and is entitled "An act to continue for a limited time the provisions for summary proceedings contained in an act of the last

session, to amend the acts for promoting the drainage of lands, and for other purposes; and to amend the said act."

In the preamble to this act, the titles of three previous acts (passed within the last four years) for promoting the drainage of lands, &c., in Ireland, are recited; it is to the last, however, passed in the session of 1846, that the act of the late session is intended more immediately to apply. In that act, after referring to a failure of a portion of the potato crop of the then last year in Ireland, and to the distress which might thereby prevail among the labouring classes in certain districts, and to the expediency of giving for part of the then present year, increased facilities for various works of utility connected with the drainage and improvement of lands in such districts, it was enacted that the provisions therein after contained should be called "provisions for summary proceedings;" and that no work should be undertaken without first obtaining the assents of the proprietors of lands, with the consent of the tenants, before the 1st of August 1847. The increased pestilence of the past year, however, suggested to her Majesty's ministers the expediency of continuing, for one year longer from the passing of the act, "or before the end of the then next session of Parliament," all the "provisions for summary proceedings" authorising the commencement and execution of any works of utility connected with the drainage and improvement of lands.

The other amendments of the act of 1846 are comprised in the second and third clauses of the present act. The former declares the assent of proprietors to be sufficiently valid without the concurrence of occupiers: this has been deemed expedient, in consequence of the great delay that has ensued in the commencement of works under the previous acts, "without any commensurate advantage to the parties interested." The third clause enacts, that where, under the recited acts, a free grant of a moiety or more of the cost of any navigation connected with drainage shall be made under the authority of Parliament, the residue of the cost shall be charged upon the districts benefited, "without any declaration of the justices and associated cesspayers, and without any presentment previously made by the grand jury of the county or counties wherein such districts shall be situate."

The next act (cap. 106), passed also on the 22d of July, is entitled "An act to provide additional funds for loans for drainage, and other works of public utility in Ireland, and to repeal an act of the last session for authorising a further issue of money in aid of public works of acknowledged utility."

An insufficiency of the funds appropriated to the advancement of loans by the Commissioners of Public Works in Ireland, for the promotion of drainage and other works of public utility in that country, created the necessity for this act, which authorises the

Commissioners of her Majesty's Treasury to direct a further sum of L.120,000 to be placed at the disposal of the Commissioners of Public Works in Ireland, "before the 4th day of April next ensuing," (1848.) The second clause authorises the issue, from time to time, as may be found necessary, of "any further sums of money not exceeding L.250,000" for a like purpose. The last clause repeals the act of 1846, which authorised the issue of L.50,000 in aid of public works in poor districts in Ireland.

The third act (cap. 32) is entitled "An act to facilitate the improvement of landed property in Ireland." The "facility" contemplated by this statute is the power given to the Treasury to advance (upon application of the Commissioners of Public Works in Ireland, out of the growing produce of the consolidated fund, and as may from time to time be required) the sum of L.1,500,000; and so much of a previous act as authorised the issuing of L.1,000,000 for Ireland to be repealed. The act contains sixty-seven clauses declarative of the mode in which it is to be carried out; one or two of the principal provisions only it may suffice to specify. No loans to be advanced without security, and no one instalment of any loan to exceed the sum of L.500; the Commissioners to require a guarantee for the due application of the money; all labourers to be paid "in the current coin of the realm, and not otherwise." All loans to be subject to an annual rent-charge upon the lands specified in the Commissioners' order, of L.6 : 10 for every L.100 advanced, to be payable half-yearly for the term of twenty-two years, an option being given to owners to redeem any portion of such rent-charge "not being less than L.10 annual charge." Two schedules are appended to the act—the one, a table "for calculating rent-charges to be paid off in less time than twenty-two years;" the other, a table "for the redemption of rent-charges;" both being calculated on the assumption that a yearly rent-charge of L.6 : 10 continuing for a term of twenty-two years, is equivalent to the sum of L.100 in ready money.

Inclosure and Transference of Lands, &c.

Under this head we find four acts of the legislature passed during the last session. Of these, two are applicable to England and Wales, and two to Scotland. The first (cap. 25), which received the royal assent on the 11th of May, is entitled "An act to authorise the inclosure of certain lands, in pursuance of the Second Report of the Inclosure Commissioners for England and Wales." The preamble recites a previous act, passed for the purpose of facilitating the inclosure and improvement of commons, and lands held in common, the exchange of lands, and the division of intermixed lands; to provide remedies for defective or incomplete executions, and for the non-execution of the powers

of general and local inclosure acts, &c. The Inclosure Commissioners in the Annual General Report of their proceedings, and in virtue of the powers vested in them by the above act, had issued certain provisional orders concerning particular lands, which they had certified it would be deemed expedient to inclose, but which could not be done without the authority of Parliament. Hence the present act authorising the inclosures to be proceeded with. A schedule to the act recites the lands and localities, viz. Worcestershire—Welland; Newbold-on-Stour: Yorkshire—Harden Moor; Bordly Intack; East Cotham Common: Cambridgeshire—Wilburton Open Fields: Derbyshire—Elmton; Brough and Shatton Common: Northumberland—East Coanwood: Southampton—Dippenhall; Tadley: Radnorshire—Evenjobb: Shropshire—Wentnor; Norbury Hill: Somersetshire—Buckland St Mary: Cumberland—Whitrig Marsh: Warwickshire—Wishaw; Upper and Lower Greens; Whitmarsh: Essex—Nettleswell: Sussex—Washington Commons: Bedfordshire—Goldingtons.

The next measure (cap. 111) was passed on the 23d of July, and is entitled "An act to extend the provisions of the act for the inclosure and improvement of commons." The act with which the "extended provisions" are proposed to be incorporated is one passed in the 8th and 9th of her present Majesty, to facilitate the inclosure and improvement of commons, and lands held in common, the exchange of lands, and the division of intermixed lands, &c. The first new provision of the recent act enacts, that where the title to any manor, land, or right is litigated, the consent of both claimants shall he deemed equivalent to the consent of an actual owner. And in case of a claim where more than one person may be interested, the non-signification of dissent shall be deemed equivalent to the consent of the party so claiming under the provisions of this act. Another clause enacts that exchanges may be made of land, excepting or reserving minerals and easements: and by a subsequent provision, lands taken in exchange or on partition, or as allotments in respect of copyhold or customary lands, shall be held to be copyhold, and shall be held of the same lord. The remaining clauses are merely formal.

The third act (cap. 48) is entitled "An act to facilitate the transference of lands and other heritages in Scotland, not held in burgage tenure." The object of this act, which is of a purely legal nature, is (as expressed in the preamble) to amend the law of Scotland, by rendering the transference of lands and other heritages "less expensive." With this view it is enacted by the above act, that in all instruments for the conveyances of lands "not held burgage," and in which certain clauses are usually inserted, more abbreviation shall in future be observed, agreeably to forms set forth in schedules annexed. The second and third clauses are

important, and which we may be excused for giving *in extenso*. The former explains the import of the clause known as "a clause of obligation to infeft," and runs thus:—

Be it enacted, that the clause of obligation to infeft, if the clause shall be limited to an obligation to infeft *a me* only, shall be held to imply an obligation on the disponer to infeft the disponee and his heirs and assignees in the subjects conveyed upon their own expenses, to be holden from the disponer, and his heirs and successors of and under their immediate lawful superior, in the same manner as the disponer, himself or his predecessors or authors, held, hold, or might have holden, the same, and that either by resignation or confirmation, or both, the one without prejudice of the other; and the obligation to infeft, if granted to be holden *a me vel de me*, shall be held to imply an obligation on the disponer to infeft the disponee and his heirs and successors upon their own expenses, by two several infeftments and manners of holding, one thereof to be holden of the disponer and his heirs and successors, in free blench, for payment of a penny Scots, in name of blench farm, at Whitsunday, yearly, upon the ground of the lands, if asked only, and freeing and relieving him and them of all feu duties, and other duties and services exigible out of the said lands and others, by their immediate lawful superiors thereof; and the other of the said infeftments, to be holden from the granter and his foresaids of and under their said immediate lawful superiors, in the same manner as the granter, or his predecessors or authors, held, hold, or might have holden the same, and that either by resignation or confirmation, or both, the one without prejudice of the other.

The next clause explains the import of other clauses set forth in one of the schedules as follows:—

Be it enacted, that the clause for resigning the lands shall be held and taken to be equivalent to a procuratory of resignation in the terms now in use, and in the case of conveyances by a vassal to his superior, as equivalent to a procuratory of resignation *ad remanentiam*; and the clause of assignation of writs and evidents, unless specially qualified, shall be held to import an absolute and unconditional assignation to such writs and evidents, and to all open procuratories and precepts therein contained, to which the disponer has right; and the clause of assignation of rents, unless specially qualified, shall be held to import assignation to the rents to become due for the possession following the term of entry, according to the legal and not the conventional terms, unless in the case of forehand rents, in which case it shall be held to import an assignation to the rents payable at the conventional terms subsequent to the date of entry; and the clause of warrandice, unless specially qualified, shall be held to imply absolute warrandice as regards the lands, and writs, and evidents, and warrandice, from fact and deed as regards the rents; and the obligation to free and relieve from feu duties, casualties, and public burdens, unless specially qualified, shall be held to import an obligation to relieve of all feu duties, or other duties and services or casualties payable to the superior, and of all public, parochial, and local burdens, due from or on account of the said lands, prior to the date of entry; and the clause of consent to registration, unless specially qualified, shall import a consent to registration and a procuratory of registration in the books of Council and Session, or other judges' books competent, therein to remain for preservation, and also, if for execution, that letters of horning and all necessary execution shall pass thereon upon six days' charge, on a decree to be interponed thereto, in common form.

The other clauses may, with one exception, be summarily adverted to. The fourth clause enacts, that conditions of entail may be referred to as already in the register of entails or register of sasines. Lands held under any real burdens or conditions or

limitations, may also be referred as already in the register of sasines. Superiors may be compelled to grant entries by confirmation. Charters of confirmation (in a form prescribed) are to imply a general confirmation of all the title-deeds of the lands. In cases where the superior's title is incomplete, the owner may in certain cases apply to the Lord Ordinary on the bills to ordain him to complete his title and grant an entry, under pain of forfeiture; or the owner may in such case apply to the Lord Ordinary on the bills to authorise application for an entry to the crown, or prince, or mediated superior, as in vice of the recusant superior. Lands to be held temporarily of the crown, or prince, or mediate superior. The party in right of the superiority may lodge a minute tendering relinquishment of his right, and if accepted by the petitioner, the Lord Ordinary may interpone his authority. Over-superior's rights not to be extended or affected. Vassal obtaining or accepting forfeiture or relinquishment of superiority to be liable for its value; but forfeiture or relinquishment is not to infer representation. Forfeiture to take effect, and relinquishment to be deemed lawful, although superiority form part of an estate held under prohibitions against alienations, &c. Precepts of *clare constat* to remain in full force, notwithstanding the death of the granter. Letters of general charge or special charge to be no longer competent. Bill for summonses of adjudication and of sale are, by this act, abolished. Decrees of adjudication and of sale to contain warrant for infeftment *a me vel de me*, and infeftment may follow accordingly. The twentieth clause being an important one, we give it entire.

Be it enacted, that any judgment pronounced by the Lord Ordinary in virtue of this act shall be subject to review by a reclaiming note in ordinary form; but the judgment of the Lord Ordinary, if not so brought under review, and the judgment of either Division of the Court upon such reclaiming note, whether such judgments shall have been pronounced in absence of the respondent or not, shall be final and conclusive, and not subject to review by appeal to the House of Lords, or by reduction, or in any other mode or form whatever; and it shall be competent to the Lord Ordinary, or to either Division of the Court reviewing any judgment of the Lord Ordinary, if it shall appear to him or them to be just in the whole circumstances of the case, to find and decern in ordinary form for the expenses of any proceedings under this act against the petitioner or respondent personally.

The next clause enacts "that it shall be lawful to the Court of Session to pass such act or acts of sederunt as the Court may deem proper for carrying into effect the purposes of this act." The act to take effect from the 30th of September 1847.

The other statute (cap. 49), which was also passed on the 25th of June, may be deemed a companion act to the foregoing, having a similar object in view, namely, to economise the expense of transferring lands; the provisions in this case being applicable to lands and other heritages in Scotland "held by the tenure of

burgage." The operation of this act, like the preceding, to date from the 30th of September 1847.

Tithes.

The only act connected with tithes passed during the last session, was one (cap. 104) that received the royal assent on the 22d of July, and is entitled "An act to explain the acts for the commutation of tithes in England and Wales, and to continue the officers appointed under the said acts until the 1st of October 1850." By the former acts the powers of the Commissioners were limited to the 31st of July 1847; and as the purposes for which the tithe commission was originally constituted are not yet completed, hence the necessity of an act of continuation. Besides the clause for extending its duration, there are three explanatory provisions: the first refers to doubts that have been entertained as to the full meaning and extent of the enactment in the original act for "the quieting of titles," which declares, that no confirmed agreement, award, or apportionment, shall be impeached after the confirmation thereof, by any mistake or informality. These doubts are now obviated by the clause in question, which enacts, that notwithstanding any exception in the former act, every instrument of apportionment confirmed by the Tithe Commissioners shall be deemed valid both at law and in equity.

The next clause provides, that instruments of apportionment may be corrected, if it shall be shown to the satisfaction of the Commissioners that such lands have been improperly included or charged with rent-charge; the expenses attendant upon such correction to be borne by such persons, and in such proportions as the Commissioners shall direct.

The concluding clause enacts, that copies of instruments of apportionment shall be delivered up to the Tithe Commissioners for the purpose of such correetion.

Highways and Turnpike Roads.

Under this head we find three acts passed during the late session, viz. two public general acts, the other a local act. The first (cap. 93) is entitled "An act to continue until the 1st of October 1848, and to the end of the then next session of Parliament, an act for authorising the application of highway rates to turnpike roads." The act to which this statute gives an extended duration, was one passed about five years since, and was limited to one year. In each succeeding session a similar act to the above has been passed for continuing the purposes of the original measure.

The next (cap. 35) is entitled "An act to continue until the

31st of July 1848, and to the end of the then next session of Parliament, certain acts for regulating turnpike roads in Ireland." This also is a short annual act for giving continuous effect to certain statutes passed in former sessions, for making, amending, and repairing the said roads.

The local act (cap. 72) is entitled "An act for the further amendment of the laws relating to turnpike roads in South Wales," and was deemed necessary for the purpose of obviating difficulties that have occurred in carrying into execution the provisions of the previously existing laws, which authorised the levying and collecting of a country road rate and tolls, and the distances within which it should be lawful to collect the same. The most important clause in this act is that which defines the mode of measuring roads in the southern division of the principality in reference to clearing of gates—doubts having arisen in what manner and along what description of roads certain distances ought to be measured, and whether portions of road within the boundaries of cities or towns separately maintaining their own roads, and whether country bridges, and the approaches thereto, and ferries, ought to be included in, or excluded from, such measurement. For the removal of these doubts the present act enacts—

Wherever there is a continuous line of turnpike road between two turnpike gates, such distances shall be measured along such continuous road:—

A turnpike road shall be deemed to be continuous, for the purpose of such measurement, notwithstanding that any county bridge, or the approaches thereto, or any ferry, or any roads within the limits of any city or town which may be maintained by any local commissioners, or which may be separately maintained according to the provisions of the said recited act, may intervene so as to form part of the line of such continuous turnpike road between two gates; and in any such case the portions of road upon, or forming the approaches to such county bridge and such ferry, shall be included; but the roads within the limits of any such city or town (if the same be a market town, but not otherwise) shall be excluded from such measurement.

The other clauses may be summarily noticed. These are—the repeal of so much of a previous act as required high constables to act in collection of county road rates; such rates to be collected by the same officers or parties as the county rate; clerks of the peace to send copies of warrants of justices to clerks of boards of guardians in certain cases; the latter officers also to ascertain the proportion which the county road rate forms of the poor rate assessment, and to give notice thereof to overseers, who are to publish notice of the proportion so ascertained, and to give certificates to ratepayers of amount of road rate paid by them; clerk to the guardians is empowered to call for rate books; refusal to comply with the same incurs a penalty of L. 5. Where a parish does not form part of a union, overseers are to act in like manner as clerks to guardians; rates made previously to the passing of

this act to be declared valid; justices of the peace empowered to fill up vacancies in county road boards occasioned by twelve months' non-attendance; tolls on roads of Presteigne trust (Radnorshire) may be reduced by the trustees acting under a former statute, compensation being made to the trustees for such diminution; certain parts of the road near Swansea to be in future under the management of the county roads board of Glamorgan; the present act to take effect from the 1st of August 1847.

Markets and Fairs.

Two acts were passed during the late sesson in relation to markets and fairs—the one a public general act, the other a local act. The former is entitled "An act to consolidate in one act certain provisions usually contained in acts for constructing or regulating markets and fairs." This statute is intended to apply to, and to be incorporated with, any measures that may hereafter receive the legislative assent for the construction and regulation of markets or fairs; the object being to avoid in future the necessity of repeating the provisions of former acts relating to such undertakings, as well as for ensuring greater uniformity in the provisions themselves. In citing this statute in other acts of Parliament, and in legal instruments, it will be sufficient to use the expression, "the markets and fairs clauses act 1847." The construction of the market or fair to be subject to the provisions of this act, and the lands clauses consolidation act of 1845, when the special act relates to England or Ireland; and to the provisions aud restrictions contained in this act, and the lands clauses consolidation (Scotland) act, 1845, when the special act relates to Scotland. The principal clauses in this act refer to—the construction and regulation of the market or fair; holding of market or fair, and protection thereof; slaughter-houses; weighing of goods and carts; stallages, rents, and tolls; by-laws; recovery of damages not specially provided for, &c.

The local act applies to Scotland, and is entitled "An act to enlarge and improve the meal, corn, and grain markets of the city of Edinburgh, and for other purposes in relation thereto." This act has been deemed necessary in consequence of the present crowded state of the Grassmarket Street, and the adjoining streets, by reason of the increased and increasing quantity of the grain brought to the stock market for sale, and also by reason of the facility of transport afforded by the various railways already formed, or in course of formation, having their termini in the city of Edinburgh or its immediate neighbourhood.

The following is the substance of the act:—The fourth clause authorises the Lord Provost, Magistrates, and Council, to purchase for the site of a new market, certain lands (specified in a sche-

dule appended to the act) "lying within the parishes of New Greyfriars and Saint Cuthbert's, in or adjacent to the city of Edinburgh." The buildings and other erections thereon having been taken down and removed, a market-house is to be erected "on some part thereof, which shall contain ample and convenient accommodation for the whole business of the markets, properly fitted up for the use of corn-merchants and corn-factors, who may sell by sample merely, and for the arrangement and exhibition of the bags containing samples of the meal, corn, and other grain, of which the stock shall have been brought to the markets by means of carts or other carriages, or within the bounds of police of the said city, by means of railways or canals, for the purpose of being exposed to sale in the said markets." The expense of erecting the market-house is restricted to L.10,000. After it shall be opened for the transaction of public business, the following corn market duties will be collectable: viz. "one halfpenny for every quarter of all wheat, oats, barley, pease, beans, or other victual or agricultural produce of the descriptions usually sold in the meal market, which shall be conveyed or brought within the bounds of police of the said city." Another clause enacts, that an additional stand-duty, not exceeding sixpence each market day, shall be levied "for each bag of wheat, oats, barley, pease, beans, meal, flour, or other description of agricultural produce, which shall be opened or exposed for sale in the said market-house." The twelfth clause enacts the provision of stalls for persons selling by sample, subject to a yearly rent of L.10 each, "payable by equal portions, half-yearly, at Whitsunday and Martinmas, in advance." A firm comprising more than one partner not to be liable for more than one rent for each stall. The sample due of sixpence each market-day, hitherto leviable, to be abolished on the opening of the new market-house. The fourteenth clause forbids any person from transacting business in the said market-house "other than those who shall at the time be in possession of stalls in the said market-house, or their *bona fide* clerks or salesmen, or than those who shall on the day of such attendance have first pitched their sample-bags, and exposed their said produce to sale in the market-house, and have paid the stand-dues," &c. A proviso to this clause permits (for the encouragement of persons who may sell by sample, and who may find it convenient to attend the markets only occasionally) "the occupation of a stall, or compartment, to be allotted for the use of such persons, on payment of 5s. each market-day; persons acting in the contrary to be liable to a penalty of 40s." A poll-tax of "one penny for every person (servants carrying or going for sample-bags alone excepted) entering the said market-house on any market-day, and a like sum of one penny for each time he shall so enter." The eighteenth

clause restricts the security to the city creditors over the market revenues to the sum of L.346 per annum, that being the net annual produce of the dues at present leviable in the corn and grain markets, including the rents of warehouse-buildings, &c., on an average of three years preceding Martinmas 1846. The next clause authorises the Lord Provost, &c., to borrow such sums of money as they shall see fit for the purposes of this act, not exceeding L.20,000, on security of the new market-house, buildings, and market revenues, subject to the previous annual payment of L.346. The twenty-fourth clause defines the application of the market revenues as follows:—first, in defraying the necessary charges of collection, management, and repairs; second, in paying the sum of L.346 to the credit of the city revenues; third, in paying the interest on monies borrowed; and, fourth, in reducing, from time to time, the sums borrowed, until the same shall be wholly paid off. The thirty-second clause empowers the several railway and canal companies, which now, or hereafter, may have their depôts or stations within the bounds of the police of the city of Edinburgh, to receive the various duties leviable on agricultural or garden produce, and on bestial, including sheep and lambs; such companies accounting for the same every three months, and reserving 6 per cent of the amount for trouble, risk, &c. The commutation duty, if levied in railway and canal depôts, to be levied on the weight of goods, viz. one penny for every ton weight, and proportionally for any smaller weight of agricultural or garden produce, merchandise, or other goods. Produce and goods *in transitu* to be exempted from duties.

Petitions.

The following petitions on matters kindred to agriculture, were presented to Parliament during the late session:—

Malt Tax.—For the repeal of this tax: 7 petitions, bearing 7254 signatures.

Colonial Corn.—For the admission of Australian, on the same terms as Canadian corn: 1 petition, with 228 signatures.

Breweries and Distilleries.—Against the use of grain in breweries and distilleries: 59 petitions, with 17,521 signatures.

Game Laws.—For the repeal or alteration of these laws: 4 petitions, each with one signature.

Smithfield Market (London).—*Against* the removal of the market, 59 petitions, bearing 4,924 signatures; *for* its removal, 28 petitions, with 16,581 signatures.

Landlord and Tenant (Ireland).—For altering the laws relating to landlord and tenant in Ireland, 13 petitions, with 5065 names.

F.

THE USE OF LIME IN AGRICULTURE.

No. I.

BY PROFESSOR JOHNSTON.

THE use of lime as an application to the soil is of high antiquity, and its utility has been recognised in almost every country in which agriculture has attained to any degree of perfection. In our country it has been called *the basis of all good husbandry*—and it certainly is more largely and more extensively used than any other mineral substance which has ever been made available in practical husbandry. I hope, therefore, I shall be rendering a service to agriculture by bringing together in the following pages the greater part of what we as yet know, in regard to the practice and theory of the use of lime.

Lime is applied to the land in several states of chemical combination and in a great variety of forms, some of them natural and others artificially prepared. I shall describe the several chemical states and the more important of the natural and unprepared forms of marl, shell-sand, &c., in which lime is employed for fertilising the soil.

SECTION I.—*Of the different states of chemical combination in which lime is found in nature and is applied to the land.*

Lime is applied to the land in various states of chemical combination, the nature, composition, and properties of which it is necessary that the reader should, in the first place, in some measure understand. It is chiefly applied in the states of carbonate, bi-carbonate, sulphate, phosphate, and silicate; but in the state of nitrate also it exists in the soil, and acts beneficially upon vegetation. I shall describe these compounds in succession.

1°. *Carbonate of lime* is the most abundant of these compounds, and that which is most generally employed in agriculture. But the meaning of this word *carbonate* it will be proper to explain.

Fig. 1.

Fig. 2.

If a few pieces of limestone or chalk be put into the bottom of a beer glass, fig. 1, and diluted spirit of salt or strong vinegar be poured over them, a boiling up or effervescence will take place. This boiling up is caused by the production of a kind of air, to which the name of *carbonic acid gas* is given.

This air will extinguish a

lighted taper introduced into it, and is so heavy that it may be poured from one vessel to another, fig. 2. It exists naturally in the limestone, and is driven out or separated from it by the vinegar or spirit of salt.

If this carbonic acid be prepared by putting the pieces of limestone and the acid into a bottle, through the cork of which a bent tube is introduced, terminating at the other end in a glass of water, fig. 3, the gas will pass through the tube, will rise in bubbles, and will impregnate the water. Water dissolves and retains its own bulk of this gas at the ordinary pressure and temperature of the atmosphere. Soda water is impregnated with it, under strong pressure; and hence the violent effervescence which takes place when the cork of a soda water bottle is drawn.

Fig. 3.

This gas exists in small quantity in the atmosphere, and hence every shower of rain that falls dissolves a little of it out of the air, and comes to the earth impregnated to a certain extent with carbonic acid. This fact, as we shall afterwards find, is of considerable practical importance.

If a small piece of *quick* or burned lime be crushed to powder, put into a bottle full of water, well shaken up, and then allowed to settle, the water will become as clear as before, but will contain lime. It will be what is called *lime-water.*

If this clear and transparent lime-water be now poured into the beer glass, and the carbonic acid gas made to pass through it, fig. 3, the liquid will become milky; and if the glass be removed from the action of the gas, a white powder will fall.

This white powder is produced by the combination of the *carbonic* acid gas with the lime contained in the water; and hence it is called *carbonate* of lime. It is the same thing as pure finely powdered chalk or limestone, and is *insoluble in pure water.*

One hundred pounds of carbonate of lime contain about 44 lbs. of carbonic acid and 51 lbs. of lime, *or one ton of pure carbonate of lime contains* 11¼ *cwt. of lime.*

2°. *Bi-carbonate of lime.*—But if the lime-water, after it has become milky, is not removed from the action of the gas, but the bubbles are still allowed to pass through it, the milkiness will gradually disappear, and the liquid will become transparent as at first. The carbonate of lime at first formed will be dissolved—through the absorption of more carbonic acid, and the formation of what is called *bi*-carbonate of lime, which is soluble in water.

If this clear solution be poured into a wide-mouthed tumbler, a film will gradually form on its surface, and if it be stirred about

or warmed, it will become milky. This is caused by the water parting with the second portion of carbonic acid which had been absorbed, in consequence of which the insoluble carbonate of lime again falls. If the water be heated, this carbonic acid is driven off more quickly, and the milkiness sooner appears.

These facts are of practical importance, as showing,

a. That carbonate of lime, though insoluble in pure water, is soluble to a considerable extent in water impregnated with carbonic acid gas. In this state of solution it exists in most spring waters.

b. That when water which holds lime in solution in this way is exposed to the air for a length of time, or is heated over the fire, the lime will again separate from it more or less completely. It is in this way that stalactites are formed in caves, that drains are often choked up with lime, that substances are frequently petrified in lakes and running streams, that beds of marl in some cases are produced, and that crusts are deposited at the bottoms of our kettles and steam boilers.

3°. *Sulphate of lime or gypsum.*—The common oil of vitriol of the shops is called *sulphuric acid* by chemists. If a drop of this sulphuric acid is mixed with lime-water quite saturated with lime, it will render it slightly milky, and a white powder will fall. The white powder in this case is a combination of the sulphuric acid with the lime, and is called *sulphate of lime.** Under the name of gypsum, this sulphate of lime is well known to the farmer.

A hundred pounds of common gypsum consist of 46 lbs. of sulphuric acid, 33 lbs. of lime, and 21 lbs. of water. When it is heated to redness, this water is driven off, and the gypsum is then very easily reduced to an exceedingly fine powder. In this finely powdered state it forms the plaster of Paris or common stucco, and is much employed for making plaster casts. When mixed with water to the thickness of cream, this fine powder speedily sets, or becomes hard. This arises from its absorbing the water it had lost by heating, and becoming again changed into common gypsum containing 21 per cent of water.

A hundred pounds of burned gypsum consist of 58½ lbs. of sulphuric acid and 41½ of lime. This weight absorbs 26¼ lbs. of water, and forms 126¼ lbs. of common gypsum.

Gypsum dissolves in 500 times its weight of pure water, or 50 gallons will dissolve one pound. Hence it often exists in spring water and in rain water which has flowed through a soil in which gypsum exists, or to which it has been added.

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* It is formed much more abundantly if a solution of chalk or limestone in spirit of salt be added to one of Epsom or of Glauber salts in water. The white powder which falls on mixing the solutions, is *gypsum.*

Gypsum in solution in water possesses the property of being decomposed when mixed with fermenting animal or vegetable matter. The water of the baths of Louesch are charged principally with gypsum. In these baths the patients remain immersed for six or eight hours a-day, at a temperature of 80° or 90° F., and during this time the waters acquire a decidedly sulphureous character, though they show no trace of it when they first issue from the spring. Inclosed in a bottle with animal or vegetable matter, a solution of gypsum becomes sulphureous. Hence sea-water, which contains gypsum, and abounds in minute animals, when kept for a time in a close vessel, becomes sulphureous. Mixed with the mud of the sea-shore, gypsum is also decomposed; and hence the sulphureous odour which the sea-breeze brings with it over low tracts of muddy land which are deserted by the sea when the tide retires. The unhealthy character of the African coasts has been ascribed by some to the prevalence of such sulphureous exhalations. It can scarcely, I think, be doubted that gypsum, if present in the centre of a hot fermenting dung heap, will undergo a similar decomposition.

Fig. 4.

4°. *Phosphate of lime.*—When a piece of phosphorus is kindled in the air or under a glass, fig. 4, it burns rapidly and gives off dense white fumes. These white fumes which will collect on the sides of the glass in the form of a fine white powder, are *phosphoric acid.** This phosphoric acid unites with lime, and forms *phosphate* of lime.

Phosphate of lime is laid upon the land in two forms—

a. In that of *earth of bones.* When bones are burned in an open fire, they leave a bulky white porous ash, which consists of a peculiar phosphate of lime mixed with a little carbonate of lime. One hundred pounds of this phosphate consist of 48½ lbs. of phosphoric acid and 51½ of lime.

b. In that of *mineral phosphate* or apatite. This variety sometimes occurs in nature, in veins and in considerable masses. In this form it is known to exist in Estremadura in Spain, but it is too remote from markets to be made available, at present, for agricultural purposes. In minute quantities it exists in nearly all limestones, marls and corals; and it is only in this state of mixture that the mineral phosphate has yet been applied extensively to the land. A hundred pounds of this mineral phosphate consist of 45½ lbs. of phosphoric acid and 54½ lbs. of lime.

* The same white fumes are formed when a common lucifer match, of the variety which kindles without explosion, is rubbed upon the sand paper. The match is tipped with a little phosphorus for the purpose of kindling the sulphur.

Both of these phosphates are insoluble in water, but they dissolve readily in strong acids.*

5°. *Silicate of lime* is formed when sand and lime are melted together in a furnace. It exists in glass, in the slags of the iron smelting furnaces, and in various other substances rejected from our manufactories. It exists also in many of those rocks from which our soils are formed, and is one of the natural sources of fertility in those which are produced by the decay of the trap (whinstone), and some other varieties of igneous or crystalline rocks.

6°. *Nitrate of lime.*—When common chalk or limestone is dissolved in nitric acid (aquafortis), nitrate of lime is obtained in the solution. This nitrate of lime is often produced naturally in compost heaps to which lime has been added, and it is only in such composts that it has hitherto been added in any quantity to the land. It is also formed not unfrequently in the soil.

The chemical composition of 100 lbs. of the several varieties of lime above described, is represented in the following table:—

	Acid.	Lime.	Water.
Carbonate of lime consists of	43.7	56.3	——
Bi-carbonate of lime	60·8	39·2	——
Sulphate of lime (*gypsum*)	46·3	32·9	20·8
Sulphate of lime (*burned*)	58·5	41·5	——
Phosphate of lime (*of bones*)	48·5	51·5	——
Phosphate of lime (*mineral*)	45·5	54·5	——
Bi-phosphate of lime	71·5	28·5	——

I shall have occasion to describe the last of these substances, the *bi*-phosphate, in a succeeding section. The silicate of lime varies in composition. One of the most common varieties contains 38 per cent of lime.

SECTION II.—*Of different varieties of marl.*

By the term *marl* is understood an earthy mixture containing generally not less than one-fifth part of its weight, or 20 per cent of carbonate of lime. If the proportion of lime be less than this, the mixture is rather a marly clay or soil than a true or calcareous marl. The presence of lime in a marl is shown by putting a little of it into a wine glass and pouring over it strong vinegar or diluted spirit of salt (muriatic acid), when, if lime be present, it will boil up or *effervesce* like brisk beer.

When a piece of a stiff or tenacious marl is put into water, it loses its coherence, and gradually falls to powder. This is a very

* Such as the sulphuric (*oil of vitriol*); the muriatic (*spirit of salt*); and the nitric acid (*aquafortis*). In certain circumstances in the soil it may also dissolve in carbonic acid.

simple way of distinguishing between a marl and a stiff clay. Though this test, however, affords a presumption that the substance is a calcareous marl, it does not show the fact with certainty. It must still be tried with vinegar or some other acid.

Marls are of various kinds, differing in colour, in hardness, in dryness, and in the proportion of lime they contain.

1°. *Dry marls.*—The dryness of a marl is a point of considerable importance in an economical point of view, especially where it has to be carted to any considerable distance. Dry marls are also of various kinds.

a. Powdery marls.—These are generally the driest, the most easily spread, and the richest in lime.

b. Clay marls have the appearance of a more or less tenacious clay. If they contain much lime, they fall to powder when put into a basin of water.

c. Stony marls are often richer in lime than those which are clayey. They are generally spread upon the land in their stony state in the autumn, when they crumble and fall to pieces under the action of the winter's frost.

2°. *Wet marls.*—Some marls are not only very wet when they are dug up, but take a very long time to dry when they are laid in heaps in the open air. Among these are especially to be noticed the peaty marls which in many parts of our island are found in hollow places at the foot of our hills, and covered by a greater or less thickness of peat. These marls when dug up are mixed with a certain proportion of peaty matter, which causes them to retain water with great obstinacy. Even after being exposed to the air for some months, they not unfrequently retain still one-fourth or more of their weight of water. This adds greatly to the cost of transport, and often enables sea-borne lime to come into successful competition with native marls at a considerable distance from the coast. When brought to the farm, also, their wetness prevents them from being easily and equally spread upon the land. Hence they are usually formed into composts, and laid on after a considerable lapse of time, or in the wet newly dug state they are mixed with five times their bulk of farm-yard manure. This latter mode is said greatly to improve the manure for the turnip crop.

These marls might be easily dried where peat abounds, by burning the two together in a kiln, which could be easily contrived, and which would require only a certain quantity of dried peat to set it agoing. Or when brought to the farm, they may be mellowed, dried, and made to crumble down by being mixed with a certain quantity of lime shells. The lime will be slaked by the water in the marl, and the whole will fall to fine powder. Even where the burned lime has to be brought from a considerable distance, and is therefore costly, it may be worth the farmer's

while to buy a portion of it for the purpose of thus mixing with and reducing the marl which he can procure at a cheaper rate. The proportion of lime he will require will depend upon the quantity of water which his marl contains.

SECTION III.—*Of the composition of marls.*

All the kinds of marl above described vary much in chemical composition.

1°. The following table shows how very much the *dry* marls, not only of different kinds, but of similar kinds also, may differ from each other in the proportions of carbonate, sulphate, and phosphate of lime they severally contain:—

*	COMPOSITION OF DRY MARLS.				
	Powdery.		Clayey.	Stony.	
	Luneburg.	Wesermarsh.	Magdeburg.	Osnabruck.	Brunswick.
Carbonate of lime	85·4	8·2	18·2	35·0	13·3
Carbonate of magnesia	1·3	3·0	3·8	0·9	2·6
Sulphate of lime	0·1	0·5	2·1	0·9	trace.
Phosphate of lime	2·3	1·2	0·5	0·5	1·2
Alumina	0·4	3·1	8·4	10·0	4·0
Oxides of iron and manganese	4·2	4·1	7·0	1·9	7·6
Sulphuret of iron	—	—	—	7·3	—
Common salt, potash, and soda	0·1	1·0	1·6	trace.	0·2
Quartz sand and silica	5·6	78·9	58·4	23·0	71·1
Organic matter	0·6	—	—	20·5	—
	100·	100·	100·	100·	100·

We see in the above table how very wide the differences may be in the proportions of all the compounds of lime which exist in marls of different kinds and from different localities. The first of those above mentioned—that from Luneburg—is not only very rich in carbonate of lime, but contains nearly 2½ per cent of phosphate of lime, which renders it peculiarly valuable.

That from Osnabruck, in the fourth column, is remarkable for containing nearly 7½ per cent of sulphuret of iron (iron pyrites). When exposed to the air for a length of time, this pyrites decomposes, and converts a portion of the lime into sulphate of lime (gypsum), and thus renders the marl more valuable for certain kinds of crops.

The following table shows that similar differences prevail also among dry marls from other parts of the world:—

* These analyses were made by Sprengel.

	Clay marl.	Powdery marls.		
	Ayrshire.	Banks of the Boyne.		Barbadoes.
		White.	Blue.	
Carbonate of lime	8·4	92.2	10·7	93·2
Phosphate of lime	?	?	?	0·1
Carbonate of magnesia	—	1·1	—	—
Oxide of iron and alumina	2·2	—	4·1	1·6
Organic matter	2·8	1·4	1·1	0·5
Clay and siliceous matter	84·9	3·1	80·1	4·6
Water	1·4	1·5	2·0	—
	99·7	99·3	98·0	100·

The marls from the banks of the Boyne have been formed from the finer parts of the decayed mountain limestone rocks of Ireland, deposited in the valley through which the Boyne flows, and in different localities mixed with more or less of the fine clay washed down the river along with them.

2°. The *wet* or peaty marls are not in general mixed with so much clay, but they not unfrequently contain a considerable per-centage of decayed vegetable or peaty matter. This appears from the following analyses of three varieties of such marl, after being perfectly dried:

	COMPOSITION OF PEATY MARLS FROM		
		Logie, Forfarshire.	
	Caithness.	top of the bed.	bottom.
Carbonate of lime	84·7	77·6	81·7
Oxide of iron and alumina	1·6	1·8	0·6
Organic matter	4·5	14·6	4·6
Insoluble, chiefly siliceous matter	9·2	6·0	3·1
	100·	100·	100·

The organic matter in these marls, when they are made into composts, renders them more valuable to soils which are poor in vegetable matter, than the pure white powdery marls in which scarcely any organic matter is present.

The large quantity of water which these marls generally retain, and for so long a time, is, as I have already mentioned, so great a drawback to their sale and usefulness, from the cost of cartage which it involves, that it is very desirable to dry or burn them in some cheap way by means of the peat along with which they are found. After being burned with peat, the Logie marl above analysed was found to contain a large per-centage of gypsum, as appears in the following statement of its composition:—

					Logie marl, burned with peat
Carbonate of lime	...	...	...	...	82·2
Sulphate of lime (gypsum)		...	...	...	8·6
Oxide of iron and alumina		...	...	...	1.2
Siliceous matter	...	...	...	...	5·7
Organic matter	...	...	...	...	1·0
					98·7

This gypsum will render the marl more valuable, especially as a top-dressing for grass and clover. The gypsum was produced through the agency of the sulphur contained in the peat. Other advantages, therefore, besides the mere diminution in weight, would result from even the partial burning of these peaty marls.

SECTION IV.—*Of the origin of marl beds.*

Beds of marl are generally met with in hollows, near the foot of hills, or in the lower parts of valleys, the sites of ancient lakes of greater or less extent. The waters of these lakes have been impregnated with lime which has gradually been deposited upon the bottom—until, in the lapse of time, it has formed the existing beds of marl.

There are two circumstances in connexion with the deposition of marl beds, which are worthy of consideration:—

1°. The source of the lime.

2°. The way in which it is deposited or thrown down to the bottom of the lake.

I shall advert to these points in succession.

1°. *The source of the lime.*—The lakes in the bottoms of the valleys are fed by streams or springs from the hills, or by the waters which, after rain, sink through the soil and rocks, and find their way to the lowest level. The waters which thus reach the lake must bring the lime with them, either in the state of a fine suspended mud, or in a state of solution.

If a heavy fall of rain descend upon a range of chalk hills or downs, we can easily understand how the flooded streams may become milky by the fine particles of chalk they will wash away with them. But when these streams empty themselves into a lake, where the waters are comparatively still, the fine chalk will settle to the bottom, and form a layer of marl, which will be increased by every new flood, till at length it becomes a bed of appreciable thickness. In chalk countries, and in other districts where soft limestones abound, extensive deposits of marl have been formed by this purely mechanical process.

But the greater part of our marl beds has been deposited from waters holding lime in a state of solution. When lime abounds in the rocks of which the hills of a country are composed, the waters that descend along their sides, or flow from them in springs,

are always to a considerable extent charged with lime. It is a common character of those limestone rocks to which the name of carboniferous or mountain limestone is given, to be traversed by fissures often of great depth, from which copious springs not unfrequently issue, and the waters of such springs almost invariably contain a large quantity of lime. Such copious springs gush out at intervals along the base of the Penine range of limestone hills which form the western borders of Yorkshire. In rocks also among which limestone does not appear in distinct and workable beds, it is often so generally diffused that the waters which issue from them always hold lime in solution. This is the case not only among such as are called *stratified* rocks—because they occur in beds or strata lying over one another—but in those masses of trap or whinstone of various kinds, which do not lie in beds, but which often form whole ranges of hills, like the Ochil and part of the Pentland ranges in Scotland. These trap-rocks almost invariably contain a considerable proportion of lime disseminated through them, and hence the waters which flow over or pass through them are rarely free from a considerable proportion of lime.

The following imaginary section from Arthur's Seat to the Calton-hill, in the neighbourhood of Edinburgh, shows the rela-

Fig. 5.

tive position of the trap-rocks T, of which these hills chiefly consist, and which contain much lime, and of the hollows into which the waters which descended from them collected in ancient times, and formed lochs and marshes. It was because the waters of these lochs contained much lime in solution, that the bottoms of all the deep hollows around Edinburgh, though now drained, are covered with beds of shelly marl of greater or less thickness, sometimes also overlaid by many feet of moss.

The following section again, across the valley of Strathmore, shows the relative position of certain stratified and unstratified rocks, which both co-operate towards the production of beds of marl.

Fig. 6.

In this section, 1, 2, 3 represent the relative positions of the three kinds of rock which form what is called the old red sandstone formation in that district—the faint lines over 1 being certain thin and marly strata, in which beds of lime abound. In both 1 and 3 limestones occur, so that the springs that issue from both are more or less calcareous, but they are more plentiful in the upper part of 1.

The rock T is the trap which on the one side of the valley lies under the Sidlaw hills, and has probably been the means of lifting them up, while on the other side it comes to-day and forms the surface of the hilly country; *t t* are beds and masses of trap which are met with among the rocks 3, about the top of the Sidlaws. These trap-rocks, as they decay, also yield lime to the water that passes through them; so that in this locality, both the stratified and the unstratified rocks contribute to give to the waters a highly calcareous character: and hence the numerous beds of wet and peaty marl which are found in the hollows at various places along this beautiful and extensive valley.

The presence of lime in waters thus loaded with it, is in our climate shown naturally by the *water-cress*, which lines the sides, or plants itself over the entire bottom of the shallow stream, and accompanies it along its whole course from its native hills, till it empties itself into the large river, or into the comparatively stagnant lake. In practice it is easily detected by the hardness of the water, by the difficulty of washing in it with soap,* and by the deposit it forms when boiled.

These calcareous waters descend into the hollows, and form lakes or marshes. But how is the lime they hold in solution separated from them, and deposited in the form of marl?

2°. *How is this lime deposited?*—There are three causes by which, under different circumstances, the lime is separated from the water.

a. When the waters fall into a lake or hollow which has no outlet, the level of the lake must be kept down by evaporation only. As much water must rise in vapour into the air as runs in from the springs or brooks. But the water which thus rises leaves behind it the lime and other substances it has held in solution—and if the lime is abundant, it must fall to the bottom, and produce a deposit of marl.

b. Or, if the waters as they fall into the basin hold lime in solution in consequence of the excess of carbonic acid present in

* The *comparative* hardness of any number of waters may be ascertained by dissolving Castile soap in spirits of wine, and pouring a little of the solution into the several waters. That which forms the most curd, when shaken, or is the most milky, contains the most lime.

them, then by prolonged exposure to the air, and especially during sunshine (Morren), this carbonic acid will diminish in quantity, and, consequently, insoluble carbonate of lime will separate. If a rapid river rush through the lake, the fine powder which thus falls may be swept away; but if the waters be still, it will gradually subside, and form a marl bed at the bottom.

c. It is observed that in limestone districts, and in the hedgerows of fields which have been long and plentifully limed, land snails abound, and other animals which live in shells.* They do thus abound and multiply, because the materials for the construction of their shells are easily and plentifully obtained.

So it is with the shell-fish of our fresh-water lakes, rivers, and ditches. They appear in greatest numbers in the waters from which, besides their own food, they can most abundantly obtain the materials for the construction of their shells. Hence the reason why they abound in some lakes and are rare in others. Some mountain streams are almost entirely free from lime, and hence few or no fresh-water shells are met with even in the lakes into which they fall. But where lime is present, they extract it from the water, build it up into their shells, and, when they die, leave these solid shells at the bottom to accumulate and solidify into beds of marl. Hence many of our fresh-water marls, especially those wet marls which cover the bottoms of all the old lakes and deep hollows in the neighbourhood of Edinburgh, and which lie below beds of peat in Ayrshire, Forfarshire, and Caithness, are in great part composed of the visible fragments of shells of various kinds and sizes.

d. But waters rich in lime abound not merely in shell-fish properly so called, and such as I have now described, but in minute forms of animal life also which escape the unaided eye. A fine chalky mud collects at the bottom of a lake, and we fancy it must consist of minute particles of carbonate of lime, which have formerly been held in suspension or in solution by the water, and have been separated from it by some merely mechanical or chemical form of deposition, such as those above described (*a* and *b.*) But put a little of this mud under a powerful microscope, and it is instantly seen to consist of myriads of minute shells, the former residences of creatures far too small for the human eye to perceive. Take up now a drop of the transparent and apparently pure water, and dry it upon a bit of glass, a white stain will be left almost invisible to the naked eye. But examine this stain

* Of these the *Helix virgata* is especially abundant near the coast about Whitsand Bay, in Cornwall, and in the south of Devonshire. It is a prevailing opinion in these places that these snails contribute not a little to fatten sheep, the ground being literally covered with them.

by the aid of the microscope, and in it will be recognised many of the same forms as were previously discovered in the marl.

Thus those minute animals still live, still swarm in the waters. It is their invisible shells which, as generation after generation died, have collected in such vast quantities as to form beds of marl of many feet in thickness.

To these minute creatures the name of *infusorial* animals has been given. Some of them are so minute, that a cubic inch of stone has been calculated to contain the remains of 41 thousand millions of them—and yet deposits composed almost entirely of such remains have been met with of 20 and 30 feet in thickness. How very striking it is to find the united labours of these invisible creatures capable of producing such extraordinary effects! How very little we really know of what is going on around us!

Thus marl beds of fresh-water origin may be produced by mechanical deposition caused by the gradual evaporation of water containing lime—by chemical deposition when the carbonic acid by which it is held in solution is given off into the air, or decomposed by the sunshine—by the accumulation of the dried shells of visible animals which have lived in the water—and by the deposition of the minute shields and shells of invisible creatures which float in countless numbers in every stagnant pool. Of these causes the last is probably the most extensively prevalent and that by which the largest deposits of marl have been produced.

In the above remarks I have spoken only of fresh-water marls. But deposits of marl mixed with marine shells are constantly taking place at present at the bottom of the sea, and many flat (Carse of Stirling) and hollow-inland tracts which have been formerly beneath the sea, are found to be covered by such beds of marine marls at a greater or less depth below the present level of the land. The remarks made above in regard to fresh water, apply equally to the sea. The same mechanical and chemical causes operate to throw down lime—the shells of animals, only of different species, are deposited in vast numbers—and infusorial animals float in every sea, and deposit their dead skeletons, shields and shells, in every bay and estuary.*

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* On a recent occasion, when the Leith Docks were cleaned out, a large quantity of black mud was collected, which was carted away by the neighbouring farmers. A portion of it being sent to me for an opinion as to its value, I found it to contain a considerable quantity of animal matter, with much finely divided silica. Suspecting this silica to consist of the remains of infusoria, I submitted it, with the original mud, to the microscopical skill of my friend Dr Stark, who found the mud to consist, in large proportion, of living and dead infusoria, of most of which the siliceous matter formed the skeletons. These infusoria, therefore, now abound in the waters of the harbour of Leith.

Section V.—*Of Shell and Coral Sands.*

Shell and coral sand are forms in which in some parts of the world lime is largely laid upon the land.

1°. *Shell sand.*—The sands that skirt the shores of the sea are found in many localities to be composed, in large proportion, of the fragments of broken and comminuted shells. These form a calcareous sand, mixed occasionally with portions of animal matter, and, when taken fresh from the sea-shore, with some saline matter derived from the sea.

Such is the case in many places on the coast of Cornwall. From these spots the sand is transported to a distance of many miles into the interior, for the purpose of being laid upon the land. It has been estimated * that seven millions of cubic feet are at present employed every year in that county for this purpose.

On the western coast of Scotland also, and on the shores of the island of Arran and of the Western Isles, this shell-sand abounds, and is applied extensively, and with remarkably beneficial effects, both to the pasture lands and to the peaty soils that cover so large an area in this remote part of Scotland. It is chiefly along the coasts that it has hitherto been extensively employed, and it is transported by sea to a distance of 80 or 100 miles. "In the island of Barray alone, there are four square miles of shells and shell-sand of the finest quality, and of an indefinite depth." † When covered with a dressing of this shell-sand, the surface of the peaty land becomes overspread with a sward of delicate grass—and the border of green herbage that skirts the shores of these islands in so many places, is to be ascribed either to the artificial application of such a dressing, or to the natural action of the sea winds in strewing the fine sand over them, when seasons of storm occur.

This beneficial action of the winds is seen to advantage in the low flat island of Tiree. The sea winds sweep right across nearly the whole of it, and thus spread a thin and even covering of fine shell-sand over its surface. Thus it is gradually raised above the sea, while at the same time its cultivation can be kept up.‡ But at the northern end of Tiree and in the island of Coll, where rocky hills arrest the winds, the shell-sand accumulates, and forms a barren waste.

The coast of Ireland is no less rich in shell-sand in many parts

* De la Beche's *Geological Report on Cornwall, &c.*, p. 480.

† Macdonald's *Agricultural Survey of the Hebrides*, p. 401.

‡ The inhabitants grow and export bear, and import oatmeal in return (James Wilson.)

both of its northern and southern coasts. A century and a half ago, it is known to have been used for agricultural purposes in the north of Ireland—and nearly as long ago to have been brought across to the opposite Galloway coast of Scotland with the view of being applied to the land (Macdonald.)

On the coasts of France, and especially in Brittany—on the other side of the English Channel, opposite to Cornwall—it is obtained in large quantity, and is in great demand. It is applied to the clay soils and to marshy grass lands with much advantage, and is carried far inland for this purpose. It is there called *trez*, and is laid on the land at the rate of 10 to 15 tons per acre. On the southern coasts of France, where shell-sand is met with, it is known by the name of *tanque* or *tangue*.

The shell-sand of Cornwall contains from 40 to 70 per cent of carbonate of lime, with an equally variable small admixture of animal matter and of sea salt. The rest is chiefly siliceous sand. Two specimens of *tangue* from the south of France, analysed by Vitalis, and one of shell-sand from the island of Isla, examined by myself, consisted of

	Tangue, from the South of France.		Shell-sand from Isla.	
Sand, chiefly siliceous	20·3	40	71·7 to	65·7
Alumina and oxide of iron	4·6	4·6		
Carbonate of lime	66·0	47·5	28·0 to	34·0
Phosphate of lime	?	?	0·3	0·3
Water, and loss	9·1	7·9	—	—
	100·	100·	100·	100·

3°. *Coral sand* is similar in its nature to the shell-sand with which it is often intermixed on the sea shore. It is collected in considerable quantities, however, by the aid of the drag—being torn up by the fishermen in a living state—on the south coasts of Ireland (Bantry Bay and elsewhere), and on the shores of Brittany, especially near the mouths of the rivers. According to Mrs Hall, the coral sand raised in Bantry Bay alone produces L.4000 or L.5000 a-year to the boatmen who procure it, and to the peasants who convey it up the country.

The coral sand is preferred by the farmer in the fresh state, probably because it contains both more saline and more animal matter than after it has been for some time exposed to the air. This animal matter—derived from the bodies of the minute animals which form the coral—enables it to unite in some measure the beneficial effects which follow from the application of marl and of a small dressing of farm-yard or other valuable mixed manure.

Payen and Boussingault ascribe the principal efficacy of the

shell and coral sands to the small quantity of animal matter which is present in them. These chemists estimate the relative manuring powers of different substances applied to the land by the quantities of nitrogen which they severally contain, and thus, compared with farm-yard manure, attribute to the shell and coral sands the following relative values:—

	Contain of nitrogen.	Relative values
100 lbs. of farm-yard manure	0·40 lbs.	100
" of coral sand (*merl*)	0·512 lbs.	128
" of shell sand (*trez*)	0·13 lbs.	32½*

That is to say, that, in so far as the action of these substances is dependent upon the nitrogen they contain, fresh *coral* sand is nearly one-third more valuable than farm-yard manure, while fresh *shell* sand is only equal in virtue to one-third of its weight of the same substance.

Though much reliance is not to be placed upon this method of estimating the relative values of manuring substances, yet the fact that so much animal matter is occasionally present in the living corals, accounts in part for the *immediate* effects of this form of calcareous application. This animal matter acts directly and during the first year; the carbonate of lime begins to show its beneficial influence most distinctly when two or three years have passed.

3°. *Infusorial sand.*—Under this name I wish to give a separate notice of a kind of fine mealy-looking sea sand used extensively in Normandy upon the light sandy soils, and which is often carted many miles inland. Mr Lorimer of Aberdalgie, in a late excursion along the coast of Normandy, of which an account was published in this Journal, was struck by the preference which was given by the local farmers to this fine meal over the banks of shell-sand which abound also on the coast, and he sent me a portion of it for examination. Upon analysis it was found to consist of—

Organic matter	5·06
Chloride of sodium (common salt)	1·01
Gypsum	0·32
Chloride of calcium	0·73
Magnesia	trace.
Carbonate of lime	43·50
Alumina	0·17
Oxide of iron	1·20
Oxide of manganese	trace.
Insoluble siliceous matter	47·69
	99·68

* *Annales de Chim. et de Phys., third series*, iii. p. 103.

From this analysis it appears that the value of this mealy sand does not depend solely upon the lime (43½ per cent) it contains, but is derived in some measure also from the 5 per cent of organic matter, and the 2 per cent of soluble salts which are present in it. It is remarkable also for containing nearly half its weight (48 per cent) of siliceous matter in the state of an exceedingly fine powder.

When examined under the microscope, this sand is seen to consist of minute crystals of carbonate of lime, of broken limbs and claws of small crustaceous animals, and of the shells or sheaths of numberless infusoria (Dr Stark). These shells or sheaths belong in large proportion to species which absorb silica from the water instead of lime, and form flinty instead of calcareous shells or sheaths. Hence the source of the siliceous and organic matters which this lime-sand contains.

Its value over the coarser shell-sand, therefore, consists in its organic matter and soluble salts, and in the minute state of division in which its particles are found. This fine powdery state enables it to be mixed more intimately with the soil—causes an equal weight to go further—and prevents it from opening and rendering still lighter the sandy soils of the country as the coarse shells would be apt to do. In Normandy it is generally applied in the form of compost, and is extensively mixed with the farm-yard manure, which it is said greatly to improve.

SECTION VI.—*Of Limestone Sand and Gravel, and of Crushed Limestone.*

1°. *Limestone sand and gravel.*—In countries which abound in beds or hills of limestone, there are found scattered here and there in the hollows and on the hill sides, banks and rounded heaps of sand and gravel, in which fragments of limestone abound. These are distinguished by the names of limestone sand and gravel, and are derived from the decay or wearing down of the limestone and other rocks by the action of water. Such accumulations are frequent in Ireland. They are indeed extensively diffused over the surface of that island, as we might expect in a country abounding so much in rocks of mountain limestone. In the neighbourhood of peat bogs these sands and gravels are a real blessing. They are a ready, most useful, and largely employed means of improvement, producing, upon arable land, the ordinary effects of liming, and, when spread upon boggy soils, enabling it, without other assistance, to grow sweet herbage, and to afford a nourishing pasture. The proportion of carbonate of lime which these sands and gravels contain is very variable. I have examined two varieties from Kilfinane, in the county of Limerick—the one, a yellow sand, contained 26 per cent of carbonate of lime, the residue being a fine red sand, chiefly siliceous—the other, a fine gravel of a grey colour, contained 40 per cent of carbonate of lime in the

form chiefly of rounded fragments of blue limestone, the residue consisting of fragments of sandstone, of quartz, and of granite.

The application of these mixed sands to the boggy land will not only consolidate and otherwise improve the physical character of the soil, but will greatly benefit its chemical composition. The fragments of granite, containing undecomposed felspar and mica, will supply potash, and perhaps magnesia, to the growing plants, and will thus materially aid the fertilising action of the limestone-sand with which they are mixed.

2°. *Crushed limestone.*—It was probably the good effects which were seen in the Western Isles to follow from the drifting of the shell-sand upon the mossy fields, and from the application of the limestone gravel in Ireland, that suggested to Lord Kames and others the application of crushed limestone to similar land in the remote districts of Scotland. There are numerous places in which limestone and water-power abound together, but where coal is so scarce and dear that it would be impossible to reduce the limestone by the ordinary method of burning. In such localities the erection of a pair of crushing rollers such as are used at our lead and copper mines, to be turned by water-power, would be an economical method of obtaining the means of liming and improving the land. I have been in Highland districts, remote from coal, where miles of hill pasture promised to double their value, if open drained and limed, while every here and there copious streams flowed down the hill sides, over beds of limestone rock. How easily here, and how cheaply, might the means of improvement be made available! Many years ago, I believe at the suggestion of Lord Kames, this mode of crushing was adopted on the estate of Struan in Rannoch, Perthshire. I do not know for what reason it was afterwards abandoned.

There are also many localities in which rocks, rich in calcareous matter, abound, which are nevertheless so impure, contain so much earthy matter, that they cannot be burned into lime. The abundance and cheapness of fuel in such districts will not aid the farmer. He must still bring his lime from a great distance, and probably at a great expense. But if the rocks in his own neighbourhood were crushed, they might afford him a cheap and valuable dressing for his land. I am satisfied that there are many places in which limestones of this impure character, which are really useless for building purposes, which do not fall to powder when burned, and have therefore been hitherto neglected as useless, might, by crushing, be made extensively useful for agricultural purposes. The siliceous limestones of the millstone grit, and of the old red sandstone (corn stones)—the earthy calcareous beds of the mountain limestone, and many of the calcareous strata of the silurian rocks—might thus be made to improve more extensively the localities in which they are severally met with. The

rich limes now brought from a great distance, and at much expense, might be in a great measure superseded by the use of the native produce of the district.

Section VII.—*Of the Use of Chalk.*

Chalk is another form of carbonate of lime, which occurs very abundantly in nature, and which, from its softness, has in many parts of England been largely applied, and with much success, in liming the land.

The practice of chalking prevails more or less extensively in all that part of England over which the chalk formation extends. It is usually dug up from pits towards the close of autumn or the beginning of spring, when it is full of water, and is laid upon the land in lumps. During the winter's alternate frost and thaw, the lumps of chalk fall to pieces, and are readily spread over the fields in spring. It is the porosity of the chalk that fits it for being applied in this way to the land. It drinks in and retains the rain water in its pores; this water freezes in winter, and expands in all directions; the particles of chalk are therefore torn asunder from each other, and, when the thaw comes, fall to powder. If the chalk be dry, it does not fall to powder, and cannot therefore be equally spread over the field or mixed with the soil.

I am not sufficiently acquainted with the chalk districts to know upon what *principle* the application of these top-dressings of chalk is usually made by the practical man. In Hampshire, I am informed that it is never applied to the thin soils, resting on chalk, except when they are supposed to be nearly deficient in calcareous matter, or, as it is called there, *wood-sour*. I do not know, however, whether the practice of farmers in other districts is uniformly regulated by the same principle.

The application of chalk to the chalk downs in the south of England, and to the wolds of Lincolnshire and Yorkshire, is of very old date, and experience has shown that repeated top-dressings of chalk may be made with advantage, even upon thin soils of a few inches, which rest immediately upon beds of chalk. It is a singular fact that the thin black soils of the South Downs sometimes contain scarcely a trace of lime; upon breaking them up, the first thing done is usually to dress them with chalk.

Where chalking is extensively practised, the deeper beds of chalk are in general preferred. Pits are sunk to a considerable depth, and the chalk which is raised from them has long been reckoned more beneficial than that which lies nearer the surface. The farmer who will apply many tons per acre of this under-chalk would refuse to bring up with his plough a single inch of that which lies immediately beneath the thin covering through which his plough is yearly drawn.

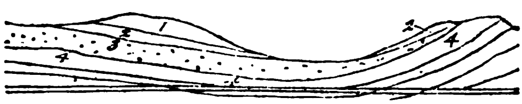
So much is this the case, that the chalk of an entire district is

sometimes rejected by the farmer, and he will rather bring another variety from a great distance, than incur the less expense of laying on his land that which is met with on his own or his neighbour's farm. Thus, the Suffolk farmers prefer the chalk of Kent to lay upon their lands, and are at the cost of bringing it across the estuary of the Thames, though chalk rocks lie every where around and beneath them.

The reason of this practice is no doubt founded upon some chemical difference between the upper and the under chalks, which has not hitherto been investigated by analysis.

The relative position of these beds of chalk is represented in the following diagram:—

Fig 7.



in which the bed 1 represents the London clay; 2, the plastic clay immediately below it; 3, the upper chalk, with flints rising to the surface in Suffolk; and 4, the lower chalk, without flints, which lies too deep to be reached by the Suffolk farmers, though it comes to the surface in Kent, and is there abundant and easily accessible. The under-beds, which are free from flint, produce naturally a stiffer, a more tenacious, and a more fertile soil than the upper chalk; and hence, probably, the benefits which follow from their application to the thin and poor soils of the latter. Still the precise chemical differences between the two are not yet understood, and it is very desirable that they should be investigated.

Where these upper chalks form the surface, there is a very general—perhaps in many places a well-founded—prejudice, against bringing up any fresh chalk with the plough. The cultivator prefers to work on with his shallow soil, rather than, by attempting to deepen it, to run the risk of injuring his land. But the enlightened opinions which are now every where spreading in regard to the importance of depth of soil, are gradually leading enterprising agriculturists to break through old customs, and to try, in a more skilful manner, those means of improvement which have hitherto, from local reasons, been considered inapplicable to the district in which they live. A very bold step of this kind has, among others, been taken by Mr Hewitt Davis, at Seldon farm, near Croydon, in Surrey, which rests upon the upper chalk. With the view of deepening a soil of six inches, he has brought to the surface seven or eight inches of pure chalk, after having drained it to a depth of not less than three feet. The immediate effect he informs me is not striking, but certainly not disadvantageous to the land. He has been enabled, however, now that

time has mouldered it, to grow deep-rooted crops of clover, beans, cabbage, and swedes, which throve but poorly before, and to *treble* the value of the land. There is certainly a large field for useful improvement in the chalk districts, if pure chalk can be ploughed up in this way, with benefit to the soil and a profitable return to the farmer. This opinion meets with still further confirmation from the recent experiments of Mr Huxtable.

ON THE INFLUENCE OF RAILWAYS—ROAD REFORM.

It is proverbially difficult to interpret the signs of the times—it is hard to read the book of the present; and whilst our eyes are fixed upon those prominent events which float as it were on the surface of society, we often remain altogether unconscious of deeper and more powerful influences, which are silently operating the social changes which we experience. Our attention is engrossed by occurrences either accidental altogether with reference to the time, or mere manifestations of the working of some wider principle; and we strive to account for social changes, by events which either exert no influence at all, or are the consequences of the very changes which we suppose to be produced by them.

It is only when dealing with the past that we can assign to events the degree of importance which is really their due, and it is only when changes of unlooked for magnitude have positively come about, that we begin to suspect the inadequacy of the causes to which we were disposed to attribute them whilst they were in progress. At present, for instance, we are living in the midst of changes, for which the occurrences which are presented by the history of the time, are scarcely sufficient to account, on the principles on which we have hitherto reasoned.

It is true we have money panics and panics for food; we have Spanish marriages, and the Sonderbund, and Pope Pius the Ninth—interesting phenomena all of them no doubt, but none of them perhaps of sufficient importance to account for any great or permanent alteration in the condition of mankind. Still we cling to them in our reasonings as the most important of passing events; they resemble in kind, if not in degree, the causes by which social revolutions have been effected in former times, and we know that the surest light to guide us through the labyrinth of the present, is that which we derive from the history of the past. In ascribing to them the importance which we do, we seem to be treading on sure ground, for experience has taught us the value of religion and politics as social agents; and when social changes come upon us, we naturally conclude that their influences have been in operation.

We know that the middle ages closed with a religious reformation, and that the face of society was changed. The spiritual dominion of the priesthood came to an end, their dicta ceased to be reverenced, and the 16th century saw every man the arbiter of his religious, as he had formerly been of his secular affairs. Implicit confidence and faith were exchanged for the spirit of investigation and doubt, and the most venerated maxims were at once converted into open questions. With their modes of thinking, the modes of living amongst men underwent a transformation which extended itself to their social habits, and even to their very external manners. So matters went for a time; the individual and the family differing widely from those that had immediately preceded them; the great landmarks of society, its political features, remaining pretty much as they had been before.

But another change was at hand. The external position of men had ceased to correspond to their individual and social advancement; governments were no longer adapted to the circumstances of the governed, and the eighteenth century closed with a political, as the sixteenth had done with a religious reformation. The great principle which this new reformation introduced, was a recognition of the identity between the governing and the governed—that the actions of the latter are but an expression of the will of the former, and that in the person of each individual, the duties and privileges of the ruler and of the subject co-exist. Every man thus became, within the limits which he himself had contributed to assign as those which the well-being of society required, his own priest and his own king. The second step in advance was no doubt a consequence of the first, and the germ of the political lay in the religious reformation.

Still it brought with *it* also important changes, and the face of society again assumed an entirely new expression. The spirit of inquiry now embraced not only every possible subject, but it extended itself to every possible class. All men governed, or were presumed to govern; and, consequently, all men reasoned, or were presumed to reason, for it had been discovered that knowledge was power, and many seemed to think that power was knowledge. The era of newspapers began!

There was now an end to religious and political reformations. The work of freedom was accomplished; internally and externally we were masters of our thoughts and of our actions; and the ancient obstructions to progress being removed, it seemed impossible that society should again be overtaken by a sudden deluge of improvement.

Had we then at length arrived at a permanent social condition, and were we henceforth to live quietly in the enjoyment of the attainments which we had made, and, as men and as

communities, to be exempted from the dominion of change? Such had never been the condition of mankind, and such was not to be ours. We had seen what religious and political enlightenment could effect amid turmoil and bloodshed—we were now to see what science and industry could bring forth in the midst of peace. A new element was at work, and we were to see social changes almost as sudden, and quite as remarkable, resulting from causes which had hitherto exerted little influence on the social condition of man. It was not wonderful that we should fail at first to perceive the importance of influences so new, and that their power should be recognised only when it began to manifest itself in its results.

The simple name of James Watt had been respectable for half a century as that of a scientific discoverer, before it became venerable as belonging to a great social reformer. It was not yet seen that his discoveries were to form an epoch from which men were to date in writing the history of civilisation. Long had the power which his genius had invoked been exhibiting its might, before any one suspected that it was yet to bind together the most distant regions as one land. It was not recognised as a social agent, and the thing was curious and interesting, but not very important, in the eyes of men. It was admitted, that in sailing against the wind steamers might have some advantage over sailing vessels; but, then, it was argued, and long believed, that they were totally unsuited for long voyages or boisterous weather. They were regarded as an useful invention in a limited way, since, in circumstances favourable to their use, they might effect a saving of time, but in no other respect were they objects of peculiar interest.

In like manner, when railways were at first proposed, the means of increased and accelerated communication which they promised seemed not to be fraught with the important consequences which all are now willing to attribute to them. That a Glasgow merchant should be acquainted with the state of the London market in a fourth of the time which was formerly required for the transmission of intelligence, would have been important, had he alone been the favoured possessor of the information, but then all his brother merchants were to be placed on an equal footing; and where then was his advantage? In so far as buying and selling were concerned, he was no better off than before—and in buying and selling his whole life consisted. It was no doubt seen, that, by economising the time which is required for the completion of every transaction, their number would be increased, and that accelerated communication would thus contribute to the extension of trade. It was also admitted on all hands that railways would exert a powerful influence on the relative value of the produce of different parts of the king-

dom, by placing remote districts in some measure upon a level with those which were situated in the vicinity of our larger towns. Few, however, till recently, took into consideration the social import of this latter influence.

It was not contemplated, that with cheap provisions, dull markets, and low wages, all the other peculiarities of provincial life were to pass away, and that even the very speech of provincials was to be changed—that the quiet, secluded, gossiping country town was immediately to partake of the hurry and bustle of the metropolis. It was not suspected that what was good in the smaller communities, the simpler mode of life which necessarily belonged to them, and that what was bad in them, the bigotry and prejudice arising from the contracted views which a limited acquaintance with the condition of mankind engenders, were alike to be swept away. It was not supposed that by the increased means of communication which railways and their accessories promised, the external condition of living, and the internal modes of thinking, of every man, woman, and child, in the wide community of civilised Europe, were to be affected more or less. Yet such has already in some measure been the case—such, it is now apparent, will continue to be the effect of the system more and more.

The work of assimilation between nations and communities, which peace and the consequent improvements on the ordinary means of communication had commenced, was taken up and carried on with a rapidity altogether unprecedented in the history of the world. National and local peculiarities and prejudices we now see daily melting away before its influence; and though it is difficult to imagine what may ultimately be the condition of society when once thoroughly exposed to the action of this new element of contact, it is impossible to doubt that a great social revolution will result.

When we regard it in this point of view, the subject of locomotion assumes a dignity and importance which did not before belong to it. The railway, with its electric telegraph, we can foresee, may yet become an object of interest to the philosophic historian, and even the poet may clothe the vulgar idea which its name suggests, with beautiful associations and human sympathies.

But it is with the effects of the system upon the external arrangements, rather than on the internal structure of society, that we have to do on the present occasion. This part of the investigation, affecting as it does the daily occupations and means of subsistence of large portions of the community, will possess to the minds of many of our readers a more immediate interest than those larger and more speculative views to which we have thought it right to allude in the outset, and to it we accordingly now address ourselves.

Whilst railways were non-existent, men contrived to get on

tolerably well without them, and many arrangements were adopted for carrying on the communication of the country, in which their influence was of course altogether left out of view; of these, some have now become unnecessary, others are altogether inconsistent with the existing condition of affairs. The diminution of traffic on our great public roads has opened the eyes of men of intelligence in all parts of the country to the fact that some alteration must inevitably be made on the expensive and cumbersome system by which they have hitherto been maintained. If their maintenance, even where they are required, and when they possessed all the support which the whole communication of the country could give them, was felt to be sufficiently burdensome and oppressive, it is obvious that it must become altogether intolerable, now that their utility is diminished, and that the country has undertaken to keep up the railways besides. The two systems in full force, and full vigour, cannot possibly co-exist in the same country and at the same time. Depending as they do for their nutriment upon the same source, it is not reasonable to suppose, that what was barely sufficient for the support of the one can aliment the two.

Some cheaper and more commodious method of keeping up such roads as might still be necessary for internal traffic, was therefore to be devised, and an ingenious book has accordingly been written on the subject by Mr Pagan of Cupar, a person whose intimate acquaintance with the practical workings of the present road system seems to have qualified him well for the task which he has undertaken.* Mr Pagan is a bold innovator; and his proposal is nothing short of the entire abolition of the existing system of raising the funds necessary for making and keeping in repair the public roads and bridges of the country by means of turnpike-tolls and statute-labour and bridge assessments, and the substitution of an annual rate on horses.

Before bringing forward the arguments in favour of his own proposal, however, Mr Pagan gives us, in the first part of his book, a detailed account of the present system, and its present workings. For this purpose he has selected the counties of Fife and of Kinross—a selection to which he was naturally led by the circumstance of residence and connexion, but which does not seem the most favourable for his argument, in as much as it leaves it open to the objection that the inhabitants of these counties groan more heavily under the burthens of the existing system, than any of their neighbours. On the whole, however, we believe that the statements of Mr Pagan contain a true, though it may be a slightly exaggerated, picture of the general system of road management throughout the kingdom.

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* *Road Reform*, by William Pagan, writer. 2d *Edition*, Blackwood, 1847.

There are at present, as our readers are aware, two classes of roads, supported by funds levied in a different manner, and managed upon altogether different principles—the statute-labour and turnpike roads. The statute-labour roads are supported by annual assessments upon the heritors and tenantry in the counties to which they belong, and upon householders also in certain districts.

It was intended by the statutes that a certain portion of the burden of maintaining these roads should likewise fall upon the owners of chaises, gigs, and carts; let for hire; but, from its obnoxious nature, we are informed that this part of the system has fallen into desuetude, as also in most places the assessments directed to be laid upon householders, cottagers, labourers, and tradesmen, so that the statute-labour assessment has been allowed to fall nearly altogether on the agricultural interest. It is levied in the shape of assessments on the plough-gates of land, and the rates per plough-gate (viz. fifty Scots acres, or seventy pounds of rent, in the option of the person assessed) vary in the different districts of the two counties to which Mr Pagan's report refers—from 36s., the highest, in Cupar, St Andrews, and Kirkaldy districts, to 15s., the lowest, in the Kinross and Orwell districts. The maximum of 36s. on 50 acres, is equal exactly to 18s. per horse—no doubt a heavy tax, considering that it leaves the farmer still exposed to the imposition of tolls on such turnpike roads as he may have occasion to use.

Under the statute-labour acts are comprehended the bridges, and those in Kinross-shire are maintained from the statute-labour funds, whilst in Fife they are upheld from a variety of different sources, involving a most complicated system of assessments, but still laying the whole burden on the agricultural interest. Next come the turnpike roads, which are supported from a variety of different sources. 1st. By the rents paid by the tacksmen of the different tolls. 2d. By tolls on certain public coaches reserved by the trustees. 3d. By sums paid by individuals by special agreement with the trustees of a district as a composition for their tolls. 4th. By allocations to a large amount, drawn from time to time from the statute-labour funds of the adjoining parishes, and which are expended upon the turnpike roads by the turnpike trustees, along with the proper funds of these roads.

The annual average amount levied from the public under the statute-labour and turnpike acts, for Fife and Kinross shires, and the great north road, and Kinross and Alloa road, is stated by Mr Pagan at L.33,547 : 7.

The system of letting the tolls by public roup, notwithstanding the large profit which it frequently leaves in the hand of the tacksman, beyond a fair remuneration for his labour in collecting, has been found to be the only workable one, and several very striking instances of the loss arising from a departure from it,

are enumerated by Mr Pagan. The difficulty obviously lies in finding honest collectors, and in checking their operations when the tolls are retained in the hands of the trustees; and whilst the system remains on its present footing, we believe little profit will arise from any attempt at "disappointing the toll-keepers of their birthright." The loss, such as it is, must be borne by the public, as a less one than would probably result from any other system of management. A loss, however, it unquestionably is, and one which ought to be taken into computation in weighing the evils of the present road administration.* But let us now look to the expenditure of this L.33,547 : 7, in order that we may have under our eye the relation between the sum actually expended in repairs, and the expenses of management. It is given thus shortly by Mr Pagan:—

Sums annually levied in Fife and Kinross shires, in name of statute labour, bridge money, and toll dues			L.33,547 7 0
Annually disposed of thus:—			
1. In ordinary repairs of roads and bridges,		L.16,110 17 7	
2. In expenses of management, emoluments of 100 tacksmen and toll collectors, estimated at 20 p. cent. over their rents, or L.37 : 19 : 1 each, ...	L.3795 11 5		
Collectors of statute-labour, bridge money, &c.	208 2 4		
Repair of toll-houses, &c. . .	376 17 10		
Roups of tolls, ...	159 7 5		
Clerks and treasurers, . . .	840 13 7		
Surveyors, ...	1268 14 7		
Miscellaneous expenses, . .	412 2 4		
		7,061 9 6	
3. In payment of interest of debt, ...		3,939 1 0	
4. In reduction of debt, ...		6,435 18 11	
		L.33,547 7 0	L.33,547 7 0

For L.16,110 : 17 : 7 expended on repairs, we have thus no less a sum than L.7061 : 9 : 6, which goes in management; and, as Mr Pagan says, he would be a bold man who would assert that it is not too much. Nor is this all—there are the costs of road legislation; the law expenses incurred between tacksmen and private parties in questions respecting tolls; the loss arising from toll-houses, gardens, &c., not yielding any return to the trustees, none of which are included in the foregoing statements, but all

* The following statement by Mr Anderson, at a meeting of the Clyde Bridge trustees, held on the 28th Oct. last, forms a striking contrast to the facts adduced by Mr Pagan, and which led to our making the above observations. The revenue for 1844, when the tolls were let by public roup, was L.2186; in 1845, when the trustees had them in their own hands, it was L.3530; in 1846, L.3932; and in 1847, L.4281; being in four years nearly doubled. To what extent they might have increased, had the system of letting been adhered to, is of course impossible to tell.

of which may fairly be reckoned as money lost to the public. Whence arises this state of matters, and where are we to turn for a remedy?—for, if it be true, as the above statement would show, that the expenses of collection and management are equal to nearly 44 per cent. of the whole expenditure on the roads themselves, then of a remedy assuredly we stand in imminent need.

Mr Pagan traces it entirely to the evils inherent in the system, and not to any mismanagement on the part of officials; and the remedy he tells us is to be sought—1st, in an abolition of turnpike tolls and statute-labour assessments; and, 2d, in a simplification or consolidation of the present numerous trusts into a limited number. Of the former proposal, the great panacea of Mr Pagan, we shall afterwards speak; in the propriety and wisdom of the latter, we thoroughly concur.

The simple fact, indeed, that there are within these two small counties no less than eight-and-twenty road trusts in full operation, with complete staffs of officers attached to every one of them, carries upon the face of it reasons enough to account for many abuses, and for much extravagance. It will require no argument to convince any one that the whole business could be managed by machinery much more simple; nor can it be doubted that it must both be more cumbersome and more expensive to transact with the creditors of eight-and-twenty different trusts, having eight-and-twenty different securities, than with those of two trusts, one for each county, having their security over the road funds of the whole county to which their money was lent. The experiment, it seems, has been tried with the turnpike roads, which in Fife were formerly managed by fifteen different trusts. These trusts have been consolidated, and the consequence is, that the debt with which they were formerly burdened is now rapidly diminishing. On such undoubted security as a consolidated trust affords, money can obviously be borrowed on much easier terms; and thus leaving out of account altogether the saving which arises from less complicated and numerous transactions, a direct saving is effected in the amount paid by the country in interest on debt.

The act (7 and 8 Vict. c. 91) which was passed in 1844, with a view to remedy the toll grievances in Wales, the fruit of the labours of Rebecca and her coadjutors, forms an excellent precedent for enactments of this description, and the results which have followed from it have been such as to justify the expectations of its founders, and of those who recommend its imitation in other parts of the country.

The heavy expenses attendant on the present system of road legislation would also be diminished by this arrangement. The nine local acts presently in operation in the counties of Kinross and Fife, were obtained at the cost of L.3532 : 10 : 9½; and these,

it must be remembered, are mostly acts of limited endurance, requiring to be renewed at the end of periods specified, each renewal, of course, occasioning a heavy additional expense, which must be paid out of the first moneys borrowed, or the first tolls levied under the act. Then there is the expense incurred by private individuals or by communities in discussing and opposing taxative clauses in the proposed acts; and, in short, all the other expenses incident to the procuring of an act of Parliament. Nor is there any prospect, with the present system, of a diminution in this department of legislation. "New railway stations," as Mr Pagan very justly remarks, "will require new roads; and unless an entirely different course be taken, we are likely, in future years, to have more instead of fewer local road acts." The passion, indeed, for road legislation—or perhaps the necessity on the present system—has been steadily on the increase since the union. The total number of Scottish road and bridge acts passed since that period is 350. Of these, five only were enacted between 1707 and 1750; 110 between 1750 and 1800; and the remaining 228 belong to the period which has since elapsed. For these reasons, then, we are quite of Mr Pagan's mind, with reference to this department of his subject; and we altogether concur with him in his recommendation, that these numerous local acts should as speedily as possible be abolished, and one single act for all Scotland substituted in their place, which, with the general turnpike act, would perfectly answer every purpose.

We now come to the grand suggestion—to the leading idea of Mr Pagan's book—the abolition of tolls and statute-labour assessments, and the substitution in their place of an annual rate on horses.* Having in the former part of his treatise exhibited the loss which the public sustain from the complicated and expensive method hitherto adopted of raising the funds for the support of the roads and bridges, and applying them to that object, Mr Pagan ushers in his scheme of reform by a statement of the hardships to which individual members of the community, and particular districts, are subjected, from the working of the present system. It would seem that some approximation to the Welsh spirit of resistance had exhibited itself in the quiet and sober kingdom of Fife; and indeed, if Mr Pagan may be taken as a fair specimen of his countrymen, we should say, that the feeling of disaffection towards the toll-bar system is there pretty deeply rooted. Nor does it seem to be groundless. We are told that "at Cupar, the county town of Fife, very little arithmetic is required to reckon no fewer than thirteen toll-bars within a circuit

* This proposal loses something, both of the charm of novelty and of the terrors of innovation, when we consider that the counties of Argyle and Inverness do now, and always have, maintained their roads without the aid of toll-bars, by an assessment on heritors and horses.

of three miles. Of these, indeed, so many as seven may be said to be within cry of the market cross; and five of the seven being under separate trusts, every one who has occasion to pass through them, though within the same half hour, must submit to five separate exactions of toll." At the south entrance to the town of Cupar there are two bars, so near to each other that, as Mr Pagan says, the traveller has the satisfaction of paying them both at one taking out of his purse. Beyond these bars is an excellent freestone quarry, and on the Cupar side of them there is a suburb in want of house accommodation. The tolls, however, act as a prohibition against building in this quarter; and the consequence is, that the town is extending in another direction, where stones can be procured from another quarry toll free.

Nor is it of the severity of the tax alone that Mr Pagan complains, but of its inequality also. Even in toll-ridden Fife there would seem to be whole districts perfectly free from the burden, and many important lines of road, of nine miles, thirteen miles, and even greater length, are enumerated, where no toll whatever is to be met with. This, no doubt, is a local abuse, little affecting the general argument, except in so far as it shows that the present system by no means secures an exemption from unjust impositions (even where these impositions are not) inherent in the system itself. In short, that it may be converted into an instrument of oppression, even where it is not so from its own intrinsic qualities. The effect on the state of the roads, too, is what might be anticipated. Mr Pagan mentions one road of forty-six miles in length, on which there are seven tolls. There is another road nearly parallel, by which the distance is forty-seven miles, and on it there is no toll whatever. The consequence is, that traffic has altogether abandoned the one road, and taken to the other, which necessarily is exposed to the tear and wear which properly belongs to them both. Nor are these objections as to the unequal distribution of toll-bars confined to the county of Fife. On the great road between Dundee and Perth, running through the rich and populous district of the carse of Gowrie, there is a stretch of eighteen miles, where no toll is payable. If we contrast this with another and much less wealthy district mentioned by Mr Pagan, where there are seven tolls upon seven and three quarter miles of road, we shall scarcely require further proof of the vices which, somehow or other, have crept into the present system.

But another evil, and one *inherent* in the present road system, is the amount of litigation to which it gives rise. Where so many statutes exist, questions regarding the construction of their different clauses must inevitably spring up; and accordingly we find that the reported cases in this department of our law, have become nearly as numerous as in any other. By way of illustrating this part of his subject, and convincing his reader of the

extent of the evil, Mr Pagan has appended to his book a catalogue of reported cases, chiefly selected from Mr Sheriff Barclay's very useful digest of the law of the road.

Of this work, connected as it is with the present subject, and addressed in some measure to the parties practically concerned in the management of roads, we shall take leave, before going further, to say one single word. When it was first advertised, from the name of its author we expected much—perhaps too much, for to some extent we confess we have been disappointed. Some books are valuable in proportion to the extent to which they are the result of their authors' mind, whilst others owe their value chiefly to the circumstance of his having succeeded in converting himself for the time being into an accurate machine. Mr Barclay seems to have considered the present occasion as one which called for a display of the latter qualities, and in this we do not altogether agree with him. We do not say that had another author been in question, we should positively have held the same opinion; but from a person whose legal acquirements and general powers were already so well known to the profession as those of Mr Sheriff Barclay, we should certainly have preferred a treatise to a digest. In its present shape, his book is an exceedingly useful one to the legal practitioner; but we believe that he would not only have done greater justice to himself, but would have conferred a greater boon on the public at large, had he given us more of his brains, and less of his scissors.

The number of reported cases we find amounts in all to 375; and the circumstances out of which they arise, serve for the most part to bear out the assertion of Mr Pagan, that their origin is to be traced to the present road system. Here then is another grievance, which we can scarcely refuse to add to the long catalogue of those which have been already laid to its door. We need not stop to inquire into the particular circumstances connected with these cases, or the expenses which they entail on the parties by whom they were conducted—for in those respects they differ not from other lawsuits; and that a fourpenny toll should give rise to a litigation in which expenses to the amount of L.124:18:10 were incurred, will not appear remarkable to any one who has had experience—as who has not?—of the tender mercies of the law.

Now for the remedy, for the reception of which we have, we believe, according to Mr Pagan's example, sufficiently prepared the minds of our readers. Mr Pagan asserts—and, so far as we can see, he does so upon good grounds—that, if not all, at least very many of the present grievances would at once be removed, were the public roads all over the country to be maintained by an annual fixed rate upon all horses of a workable age within each county. The number of horses kept by each individual is a pretty accurate test of the extent to which he makes use of

the roads, and may, therefore, it is thought, form the measure of his contribution to their support. Though startling at first sight, from the extent of the alteration which it seems to involve, the proposal is nothing more than a commutation by the owners of horses for their tolls and statute-labour assessments, by one payment yearly, which would entitle them to the free and uninterrupted use of all the roads within their reach.

The initial question with regard to the proposal, is of course the pecuniary one, for therein lies the touchstone of its admissibility. On Mr Pagan's showing, it contrasts favourably with the old system in this point of view. We give his comparative tables:—

We have already shown that the average yearly cost of collecting and applying the road funds of Fife and Kinross shires amounts to	L.7061	9	6
Deduct proportion applicable to roads belonging to other counties	184	15	2
	L.6876	14	4
But add estimated yearly value of the toll-houses, gardens, and weighing machines in the two counties	400	0	0
Present yearly cost	L.7276	14	4

Under our plan the cost would be as follows:—

Surveyor of assessed taxes for taking up list of horses. . .	L.100	0	0
Collector of assessed taxes for collecting	225	0	0
For clerks and treasurers, the funds being to be placed in bank, and the same person in each district to hold both offices . .	225	0	0
For contingent expenses, including management of debt and auditor's fee	125	0	0
For surveying, L.1 per mile.	845	0	0
Yearly cost under our plan. . . .	L.1520	0	0

To make the comparative view as perspicuous as possible, we state the present and proposed expenses in two columns:—

	Expenses of collection and application. Under the present system.			Under our plan.		
Collectors of statute-labour and bridge money .	L.208	2	4	L.0	0	0
Repair of toll-houses, gates, steelyards, tables of tolls, lighting lamps, &c	376	17	10	0	0	0
Advertising and rouping toll-bars . . .	159	7	5	0	0	0
One hundred tacksmen and their collectors . .	3795	11	5	0	0	0
Annual value of toll-houses, gardens, and steelyards	400	0	0	0	0	0
Clerks and treasurers	840	13	7	225	0	0
Road surveyors	1268	14	7	845	0	0
Miscellaneous expenses, ...	412	2	4	125	0	0
Surveyor of assessed taxes taking up list of horses	0	0	0	100	0	0
Collector of assessed taxes for collecting the rate .	0	0	0	225	0	0
	7461	9	6			
Less proportion applicable to roads belonging to other countries.	184	15	2			
	L.7276	14	4	L.1520	0	0

Here, then, is a difference of no less than L.5756 yearly in the single county of Fife, in favour of Mr Pagan's plan. The news seems almost too good to be true, and we do not blame those who were incredulous at first. Still it has undergone the scrutiny of persons conversant with the subject, not only in his own county, but in several others, and no material error has been pointed out. For the county of Forfar a similar calculation was made by Mr Pagan, at the request of a committee appointed on the subject of consolidating the road trusts, and to consider a plan of road reform. The results, in as far as expense of management is concerned, were as follow :—

Under the present system, ...	L.4017	1	10
Under proposed plan, ...	1143	15	0
Saving under do.	L.2873	6	10

We have thus, from the simplification of management alone, a saving to the county of Forfar by the proposed plan of L.2873:6:10; nor does the scheme appear to have struck any of the parties to whom it was submitted, as Utopian or chimerical. We find the report approved of on all hands, and ordered to be printed and sent to the Lord Lieutenant, the Commissioners of Supply, and the other dignitaries. So far, then, Mr Pagan and his project have prospered well—a *probabilis causa* has been reported in their favour, and we must now proceed to a further investigation. We think the idea of employing the government surveyors and collectors, as proposed by Mr Pagan, well worthy of consideration. Were the system to be adopted, it would certainly greatly tend to diminish expense; and the additional duties which it would impose upon them, harmonising as they would do with those which they already perform, would be comparatively trifling. "The surveyor, in course of his present duties, annually visits each locality, to charge the window and horse duties, and other taxes, and he could at the same time easily survey the horses for the road money. He would obtain returns of the numbers kept, and an additional line in the present tax papers would answer the purpose." In speaking of the reduction which he proposes of the salaries of the clerks and treasurers, Mr Pagan enters into an enumeration of the cares and toils from which, by way of recompense, his system is to deliver them for ever. They will no longer have to call meetings of trustees, nor to advertise roups, nor prepare articles of roup, nor attend on persons seeking information, nor will they have to take securities, nor collect rents in monthly instalments, nor collect coach tolls from coach proprietors, or from the Post-office. In short, their position will become in future, it would seem, pretty much akin to that of the Poet Laureate—

With plenty to get and nothing to do,
But to deck a pet poodle with ribbons of blue,
And whistle all day to the Queen's cockatoo,
And scribble of verses remarkably few,
And at evening empty a bottle or two,
Quaffingly, quaffingly.

But now comes a pinching part of the inquiry, that, viz. as to the number of horses actually at work within the two counties over which the investigation stretches. Mr Pagan, fully aware of the importance of this part of the subject, has taken very considerable pains to procure accurate information. By the co-operation of the superintendant of police, he had lists made out of the number of horses at work within the respective beats of each policeman. The same means were adopted in Kinross-shire. These reports, again, were checked, by putting them into the hands of intelligent individuals connected with the parishes embraced in them, and on these occasions we are told that in almost every instance omissions were discovered. On the whole, then, we may probably conclude that Mr Pagan's is not an over-estimate as to number. The result is as follows:—

In Fife—Cupar district,		3094
— St Andrew's, do.		3062
— Kirkcaldy, do.		2708
— Dunfermline, do.		1760
	Total,	10,624
In Kinross-shire,		841
Horses returned as at work in two counties,		11,465

This, as will be seen, is exclusive of young stock; but then Mr Pagan calculates the omissions at the minimum at 5 per cent., by which means he adds 573, making the total number 12,038. In addition to this, he proposes to impose a rate equal to one-fourth of the horse rate upon all other beasts employed in drawing or carrying, small ponies and donkeys included, and these humbler beasts he computes at the number of 200. Besides, there are the toll-houses, gardens, and steelyards to dispose of, and Mr Pagan calculates them down to the very iron gates. In this we think he is rather overpleading his case; for we believe that in many instances the removal of these, and the other alterations necessarily attending on a change of system, would more than counterbalance all the emolument which would arise from the sale of them. Let us take it, however, as we find it, for the present. He makes them to be worth in all L.4778—and the whole scheme stands thus:—

To meet the L.16,222 : 16 : 3 annually required in the two counties for the maintenance of roads and bridges, annuity for

redemption of debt in 30 years, and expense of management, a rate of 27s. 6d. per horse—supposing a uniform rate to be the advisable one—would suffice, thus:—

12,038 horses at 27s. 6d. . . .	L.15,950	7	0
200 ponies and donkeys at a quarter rate, . .	68	15	0
60 toll-houses, gardens, and steelyards, let at L.5 each,	300	0	0
18 do, to be given to the constabulary, at 5s. each,	4	10	0
	L.16,323	12	0
Sum required,	16,222	16	3
Surplus, .	L.100	0	0

Not an over-surplus for contingencies, in our estimation. Of this the rate would be—

For maintenance of roads, about . .	L.0	19	6	per horse.
For redemption of debt, . . .	0	5	6	—
For management, ...	0	2	6	—
In all, .	L.1	7	6	per horse.

In this way the management would cost only a twelfth part, or 8⅓ per cent, instead of 44 per cent, as at present.

The redemption of the debt, it will be seen, here forms a very large item, no less than 5s. 6d. per horse. We are disposed, however, to agree with Mr Pagan, that it is not too much for the removal of this hereditary plague-spot. It will no doubt be a saving in the long-run; for nothing is more certain than that the very expenses attendant on the management of a debt, in consequence of the frequent changes in the rate of interest, and the new bargains which must be struck with creditors for a rise or fall, the calling up of loans, and the seeking for new ones, the transfers, and new bonds, bills, and assignments, are of themselves sufficient to make a debt; and all of these must be borne sooner or later by the county. In so far as debt is concerned, Angusshire seems to be in a worse condition than even Fife. Mr Pagan calculates that 8s. per horse would be there required for this purpose, which brings the whole rate up to 29s., considerably higher than the rate in Fife. But in so far as the argument is concerned, it matters not what may be the rate for any individual county, so long as it can be shown to be under the expense entailed by the present system; and this, it will be obvious, is made out so soon as it is proved that the whole expenditure will be diminished. If the whole expense must be borne by the same parties one way or other, every diminution of it is a gain to them as a body at all events.

We think there can be little doubt that the proposed change would be beneficial in many ways to the agricultural interest. By having a fixed rate to deal with, instead of an indefinite number of tolls, the farmer would be better able to see his way before him, both before entering upon his farm, and during his occupancy. It

would at once put an end to the troublesome reckoning with servants about tolls, every time that they are sent to carry produce or to fetch manure; and it would also prevent the dishonest practice, which is said to be prevalent, of servants taking a considerable round by a statute-labour road in order to evade the toll, and then drinking the money with which they had been furnished by their master to pay it, thereby abusing his horses, defrauding him of his money, and endangering his property, to say nothing of the effect of such practices on their own characters and habits. By abolishing the toll-bars, an inducement would be held out to farmers to employ their horses and servants at all leisure times in bringing such articles to their farms as might conduce to agricultural improvement. Dung, lime, bone-dust, guano, would be driven in greater quantities. Drainage would be more extensively practised when tiles and stones could be transported toll free; stones and wood for inclosing lands and repairing steadings would be more readily and abundantly procured. With regard to all these operations, the first question usually put by the farmer is, what amount of tolls shall I thus incur? and the question as to whether the improvement shall be carried through or abandoned, not unfrequently depends upon the bargain which he is able (in violation of the statute) to drive with the tollman. Under the present system, grass lands pay the statute-labour assessment in the same proportion as lands under cultivation; but under the proposed system, oxen, cows, calves, sheep, &c. would pass free, and an encouragement would thus be held out to the rearing of sheep, the renting of land, and the consequent improvement of agriculture.

It is admitted by Mr Pagan that individual cases might and would occur, where persons would pay more under the proposed than under the present system. There are some localities where the statute-labour roads can be used almost entirely, and where the farmer, consequently, pays little beyond his statute-labour assessment; but then these are unfair exceptions, and exceptions which ought to be done away with, even were the toll-bar system to be adhered to.

But supposing the general principle of the plan to be assented to, and granting that on the whole a rate on horses is preferable to toll-bars and statute-labour assessments, are there not objections to it as proposed by Mr Pagan, both in itself and with reference to particular districts? We believe that there are.

1st. Mr Pagan proposes that the rate should be equal on all horses, howsoever employed—that the coach-horse, which is using the public road from one year's end to the other, every day in the week, should pay no more than the plough-horse, which may scarcely ever be upon it at all! It is no doubt true that unifor-

mity of rate would tend to the easy working of the plan, and that many troublesome questions as to the classing of horses would thus be avoided. But is this in itself a sufficient reason for adopting an arrangement which carries on the face of it such manifest injustice? It is equally true, for example, that the levying of the income tax would be greatly simplified, were it converted into a fixed rate, chargeable upon every man throughout the country, who possessed an income of L.150 or upwards. But would the saving of trouble and expense in collecting be sufficient to compensate for the injustice which would arise from the man with L.150 being burthened to the same extent as his neighbour who had L.150,000? In reference to this latter tax, we know that the system of taxing incomes derived from trade, or the exercise of the professions, at the same rate as that which arose from property, was adopted solely with a view to saving expense and trouble in collecting; and we know also the general and deep-rooted feeling of dissatisfaction to which this arrangement has given rise. In his desire for simplification, Mr Pagan would expose his system to a charge of inequality and injustice, which at its very first adoption would ring against it from one end of the island to the other.

In the matter of the rates, and the difficulties attending them, Mr Pagan conjures up to himself imaginary fears. The difficulties attending the classification in this instance, are not greater than those which exist in the levying of any other tax—for instance, the present assessed tax on horses. The lines of distinction between horses used in agriculture, and those running in public or private carriages, are sufficiently marked for all practical purposes, and regulations could easily be made, whereby, for half duty, the privilege might be granted of occasionally employing the former in the capacity of the latter.* The inducement which led to the adoption of the uniform postage rate, viz. the immense increase in the circulation of letters, which it was expected immediately to call forth, does not exist in the present instance; for, notwithstanding the remarks of Mr Pagan on this subject, we believe most of our readers will agree with us that there is not likely to be any very great increase in the number of horses kept, in consequence of the abolition of the toll-bars. The difference between 26 and 37 shillings a-year, supposing the present tax to be as represented by Mr Pagan, will scarcely enable any one to keep a horse which he could not keep now, and is not very likely to induce any one to keep horses which he does not require.

* A judicious friend has suggested to us, that a very slight modification on the present mode of rating horses under the present assessed taxes act, might answer the purpose.

Another reason for the uniform postage, besides, was, that the sum to be charged being so infinitesimal when compared with the incomes of most men, it was thought, and thought justly, that whereas it was a great boon to those whose letters were conveyed far, it could be no burthen to those who were to have them carried only to the other end of the street; and, moreover, as every one was in the habit of sending letters both short and long distances, there could be no case of individual hardship, every member of the community having at once the benefits and the burdens of the system, such as they were. None of these reasons exist in the present case, and it will be time enough for Mr Pagan to recommend an uniform rate, when he can show that all coach proprietors and stable keepers have become farmers, and *vice versa*, or when he can reduce his rate so low that its influence will not be perceptible on the pockets of any one.

2d. Supposing the system to become general all over the country, there are many districts in which the rate proposed by Mr Pagan, or even a much smaller one, would be a burden far exceeding any which they have ever felt from the toll-bars. In the Highlands, nothing is commoner than for small farmers to keep two, three, or four miserable horses, which, working on their farms, and serving the place of agricultural horses, could not well be charged as ponies, and of which the whole value, if they were to be brought to market, would not greatly exceed the rate which would be chargeable upon them for a single year. These wretched starvelings do not probably pay above two or three tolls in the course of a year, and as they pasture on the hills, their keeping costs little. Once impose a tax upon them, however, and they become a serious burden—the consequence of which would be, that their services would be dispensed with, and the little industry which there is in the Highlands would be still further diminished. Their masters would have an additional apology for giving themselves over to that indolence to which they are at all times so prone, and for trusting for their subsistence to the bounty of their lowland neighbours. The Highland districts would also be exposed, more than other parts of the country, to have their roads used by horses which never paid for their support in any shape, from the great influx of strangers into the Highlands during the summer season.

3d. But if we reckon upon a partial adoption of the system merely, a host of objections immediately spring up, which to us, we confess, seem almost insurmountable. What are you to do, in the first place, with all the farmers who live near to the borders of the county? If their farms are within the county where the horse-rate has been introduced, they are forced to pay it; and should their market town be within the adjoining county, which

very frequently happens, where toll bars still exist, they have to pay tolls also. Again, if they live within the county where tolls still exist, and the market town is in the other county, they have the continual use of the roads, without any contribution whatsoever.

With coach-horses, post-horses, carriers' horses, and the like, the case is similar; and in small counties like Kinross, they may pass over it from one side to the other every day in the year, without paying one single farthing.

If such a system were introduced, arrangements would no doubt be made for their doing so, and post-houses would be put down in such localities as to insure the evasion both of the rates and the tolls. In so far as the county of Edinburgh is concerned, or any other county in which a large town is situated, the objection that the roads were constantly used by horses which did not pay for them at all, would be a permanent one. The burden of keeping them would be entirely thrown on those having horses within the county; and although the other horses might pay in their respective counties, still no relief would be afforded to the county of Edinburgh. This objection, we find, was stated at a meeting of the Edinburgh Turnpike Trustees, and we think it is not without weight, though we do not think it of sufficient importance to call for a rejection of the whole system, if otherwise likely to prove beneficial to the country.* The same observation we may also apply to the other objections which we have made. If generally adopted, we see no obstacle to the working of the system of such a nature as might not be removed by a judicious revision of the details.

On the whole, we think that Mr Pagan has made out a strong and a good case, and we unhesitatingly recommend all whom it may concern, to give him a serious and a patient hearing. Whether his case would not have *appeared*, to the unconcerned reader, both stronger and better, if his own zeal in its advocacy had been a little less apparent, is a different matter: the strong light in which he sees every argument in his favour, however trifling, and the importance which he attaches to every sum, however insignificant, which can by possibility be transferred to his own side of the column, cannot escape observation. In his descriptions of the golden days which are to follow the removal of the hated toll-bars, his style sometimes assumes an altogether poetical altitude; and the glory which his fancy has shed over the Leith Walk *omnibi*, as he calls them (in imitation, we presume, of the *omnibi* of our transatlantic brethren), may excite a smile. Not-

* When the railway system is complete, and all thorough travelling removed from the turnpikes, this objection will of course fall to the ground, for the sole use, and consequently the sole cost of the roads, will then be left to the inhabitants of the locality.

withstanding these trifling blemishes, however, his book is a well-written and well-reasoned performance. He is evidently a sensible and judicious man; the good taste and gentlemanly feeling which he every where displays, are such as to enlist our confidence; and we doubt not that the zeal and ability which he has displayed in the public service, will one day secure for him that gratitude which the public rarely fails to bestow, sooner or later, upon those who have done them a benefit.

P.S.—Since the above was sent to press, some very decided indications of the ultimate triumph of Mr Pagan's proposal have come under our notice.

The Town-Council of Glasgow have pronounced, and have adopted, very energetic measures for converting others to their views. The subject was first brought under their notice at a meeting on the 15th October, and a committee of inquiry was then appointed. The report of the committee was favourable to the scheme, and the Council thereupon directed circulars to be addressed to the different counties, burghs, and public bodies in the county, calling upon them to join in an application to Parliament in its favour. On the 25th November the committee reported, that, in so far as they had received answers to their circulars, the proposal was almost universally approved of, and they also submitted a petition to the House of Commons, praying them to appoint a committee of their number to take the subject into their immediate consideration. The report and petition were unanimously adopted by the Council, and circulars have since been addressed to all the Scottish members, requesting their support to the petition. Circulars were also, of the same date, 20th November, sent along with a copy of the petition to Parliament to the Scottish counties and burghs, to railway companies, agricultural societies, and other public bodies, urging upon them the adoption of similar measures.

Agitation, then, the modern political panacea, is now at length fairly at work, and Mr Pagan, after a three years' waiting, will have the satisfaction of speedily hearing his proposal discussed by the highest tribunal in the country. The public press, as usual, has not been silent on the occasion; and many long, and several very able articles, have appeared on the subject, both in this country and in England, and others will no doubt follow now in rapid succession. The cause of all this increased anxiety is, as we anticipated would be the case, the effect of the railways in diminishing the traffic of the public roads, which is every day beginning to be felt more and more. The erection of additional toll-bars to guard the approaches to railway stations, the only method by which the deficiency can be met on the present system, has already been

determined on in various districts, and in East Lothian above eight or nine new bars are in the course of erection. The consequence is discontent—discontent leads to agitation; and agitation, we doubt not, on this as on every occasion where the remedy is easy and obvious, will lead to the adoption of the proposed system.

DECISIONS IN THE SUPREME COURTS CONNECTED WITH RURAL ECONOMY,

FROM 16TH JULY TO 13th NOV. 1847.

(*Court of Session.*)

Breach of Interdict—Railway Company.—James Hamilton, Esq. of Kames, having some time previously obtained an interdict against the Caledonian Railway Company, in regard to taking possession of certain property to which they were not entitled, now presented a petition complaining of breach of that interdict on the part of the Company. The Company averred, that since the date of Mr Hamilton's interdict they had obtained right to the property in question by means of proceedings before the sheriff, under the Railway Clauses and Lands Clauses Consolidation Acts, and argued that there was consequently no breach of interdict. The Court, however (2d Division), were of opinion that, assuming the statement on the part of the Caledonian Railway Company to be true, that they had acquired a right to the property in question, it was their duty to have applied to the Court to recal the interdict before taking possession, and they therefore fined them in the sum of L.300 to the Queen, found them liable in expenses, and remitted to the Lord Ordinary to recal the interdict on good cause being shown.—*Hamilton* v. *Caledonian Railway Company*, *20th July* 1847. *Jurist*, vol. xix. p. 693.

Ameliorations—Unstamped Assignation in the form of an order.—Donald Sutherland had been the tenant of a house belonging to Donald Munro, Esq. of Latheron, in the county of Caithness, and had been ejected therefrom at Whitsunday 1839. He brought an action against his landlord for the payment of L.8 : 3 : 3, which he averred was the ascertained expense of ameliorations on the premises, and which, by the custom of the county, outgoing tenants were entitled to be repaid by the incoming tenants, and failing them, by the landlord; and he included in his action similar claims on the part of other ejected tenants, which had been assigned to him by them, amounting in all to the sum of L.41 : 3 : 9.

The assignations were written at the bottom of each account, in the following form :—" Pay the above sum of L.6 : 10 : 3 sterling, and interest, to Donald Sutherland, joiner, Latheron :" and were signed by the cedents. Before the Lord Ordinary (Cuninghame) certain preliminary pleas were urged unsuccessfully, on the part of the landlord; but, having reclaimed, he further pleaded, that the assignations, or orders above quoted, were in law bills of exchange, and, being unstamped, were null. The Court (1st Division) concurred in this view, and holding the documents referred to not to be a good ground of action, while the pursuer's own account was too small to be competently sued for in the Court of Session, they dismissed the action, with modified expenses.—*Sutherland* v. *Munro*, 13*th Nov.* 1847. *Jurist*, vol. xx. p. 14.

Master and Servant— Wages for work done—Triennial Prescription.—George Mackay had been employed as a carter by James Ure, Esq. in the conveyance of timber from Rosehall, in the county of Sutherland, to the sea-side for shipment, during the years 1839-43. He had been paid for the work done in the years 1841, 1842, and 1843, but he alleged that there was a balance due to him for the years 1839 and 1840, and he brought an action against Ure to recover the amount. This he stated to consist of the sum of L.4 : 12 : 4 for 1839, and L.51 for 1840, being the contents of a bill for L.61 drawn by him upon John M'Lennan, then acting as Mr Ure's factor, and accepted by M'Lennan "per James Ure, Esq.," under deduction of L.10, marked on the back as paid to account. Mr Ure admitted that M'Lennan acted for him, but averred that Mackay had been paid in full. The triennial prescription having run against this alleged debt, and the only evidence consequently admissible being the debtor's writ or oath, Mackay undertook to prove the subsistence of the debt by M'Lennan the factor's books—which were, in the circumstances, held to be equivalent to the debtor's own writ. These books for 1840 had the following entry on the credit side :—" Balance due, L.42 : 9 : 5," and on the debit side of the same page, the following: "Folio 55, same book. Cash and goods to George Mackay, carter, L.45 : 10 : 11." The words "balance due" were in M'Lennan's handwriting. The entry referred to at folio 55 was as follows :—" Cash paid at sundry times. . . . Cash and goods to George Mackay, carter, L.45 : 10 : 11." Mackay abandoned the balance claimed for 1839, but maintained that the above documents proved the balance of 1840. The Lord Ordinary (Wood) found that the plea of prescription was elided, but the Court (2d Division) altered his Lordship's interlocutor, sustained the plea of prescription, and found that the pursuer had failed to prove by the writ of the defender that the sums claimed by him

were not paid, and were still resting owing: reserving all questions of expenses.—*Mackay* v. *Ure*, 13*th Nov.* 1847. *Jurist*, vol. xx. p. 15.

(*Court of Justiciary.**)

Statute 4 *Geo. IV. c.* 34—*Master and Servant—Error in Complaint.*—A petition and complaint under the Master and Servant Act (4th Geo. IV. c. 34) having been presented to the justices of the peace for the county of Lanark, by Robert Jamieson, manager of certain coal-pits at Cairnbroe in that county, and by Messrs Merry and Cuninghame, coalmasters there, setting forth that Walter Blyth had contravened the above statute, and Blyth having pled not guilty to the charge, a proof and certain proceedings followed, upon which the justices found the complaint proven, and sentenced Blyth to be imprisoned for 40 days, with hard labour. Blyth appealed to the High Court of Justiciary against this sentence, by bill of suspension and liberation, and pleaded that a wrong engagement had been libelled on, inasmuch as the complaint founded on a verbal contract of service, entered into in 1845 with the manager, while it appeared from the proof that at the date of the complaint, Blyth was serving under a written engagement, different in its terms from the former one, and entered into in 1846 with the masters themselves. To this it was answered, that the engagements were substantially in the same terms, though differently expressed; that the justices must be presumed to have satisfied themselves of this; and that the written engagement was merely evidence of the previous verbal one. The Court† found the conviction irregular, and suspended the sentence, with expenses.—*Blyth* v. *Jamieson and Others*, 16*th January* 1847. *Arkley's Reports*, vol. i. p. 225.

Statute 4 *Geo. IV. c.* 34—*Master and Servant—Record not bearing that witnesses were sworn.*—Upon a petition and complaint at the instance of James Hunter, manager for the Coltness Iron Company, and of the partners of the Company, under the Master and Servant Act (4 Geo. IV. c. 34), the justices of Lanarkshire sentenced Mark Gold to be imprisoned for 50 days, with hard labour. A bill of suspension and liberation was thereupon

* The sittings of the Court of Justiciary not being continuous, and Mr Arkley's reports, consequently, being published at no stated periods, it has been found impracticable to adjust the dates of these cases so as to correspond with the dates of the Court of Session and House of Lords cases; but such of them as come within the scope of this series, will be inserted from time to time as early as their publication admits.

† Lord Cockburn dissented from the judgment, on the ground that it was in truth reviewing the sentence of the justices on the merits of the case, whic under the statute is incompetent.

presented by Gold to the High Court of Justiciary, on the ground that the conviction was bad, in respect that, while the record bore that two of the witnesses had been sworn, with regard to the third witness there was no such entry. The Court unanimously sustained the objection, and suspended the sentence, with expenses.—*Gold* v. *Hunter and Others*, 24*th June* 1847. *Arkley's Reports*, vol. i. p. 318.

THE FARMER'S NOTE-BOOK—No. XVIII.

Condition of Agriculture. — *Kohl-rabi*—*Thin sowing*—*Liquid manure.* By JOHN TOWERS, M. R. A. S.—At page 183 of the last number of this Journal, I thought I had brought my review of the condition of agriculture to its close. Observation, and a variety of interesting communications from parties upon whose veracity I can rely, have however induced me to extend the subject.

Allowances, as I before stated, must be made, and in particular as respects the crops of *Swedes* and *turnips*, which appear to triumph in Scotland and the English border counties. But in our drier and warmer counties, the failure of these crops is of no unfrequent occurrence; and in the present season, after eleven months of almost invariably fine weather, wherein rain fell in quantity too small (I refer more directly to Surrey) to moisten the earth to the depth of eight inches, our turnips remain a spectacle of poverty. There are few persons who can perhaps refer to the able article by which Mr Pusey introduced the first number of the English Agricultural Journal. In that paper enough was stated to "give pause" to the southern farmer; but *he* adheres to his rotations, and the "fallow crop," as it is denominated, still introduces "the course," although in numberless instances two or three sowings are successively devoured by the beetle (Haltica) ere they can advance into the true or rough leaves; and the one which, made "out of due time," may be permitted to live, lingers on through September, an apology for a fodder crop, in lieu of early establishing its pre-eminence as the staple of the farm. Scotland is rich in its root husbandry—reports and evidences prove the fact: and it might therefore appear useless to make any appeal in a journal which is essentially Scottish. However, the work extends to the sister kingdom, and therefore it does, and will, find readers in the south, where the truths which I shall now adduce are little known, and still less experimentally proved. In page 24, *Book of the Farm*, vol. II., a table of six columns displays at one view the average yield of white turnips, yellow turnips, and Swedes, all raised in drills 27 inches apart, but standing at the several distances of 9, 10, 11,

and 12 inches asunder, plant from plant. The comparison per imperial acre, according to the several distances, presents the surprising fact, that, assuming the *white turnips* and *Swedes* to attain only the weight each of 4lbs., the yield will be 46 tons; 41 tons 8 cwt.; 37 tons 13 cwt.; and 34 tons 12 cwt.

Can we in England compete with our northern brethren in these enormous crops? Or, rather, must we not be constrained to admit, that, upon an average of produce, 15 cwt. to one ton per imperial acre should be regarded a fortunate *exception* rather than as a *rule?*

I would ask—What is the general weight of the Swede and turnip? Can 4lbs. be considered extraordinary? The imperial acre contains 6,272,640 square inches, and calculation becomes easy. "On comparing a usual crop of 20 tons of Swedes with these data, and keeping in view the distance of 12 inches aimed at between the plants, the inevitable conclusion is, that the average weight of each turnip in that crop *must be less* than 3lbs., or the distance between the turnips greater than 12 inches." "A slight difference in either of these particulars makes a great difference in the weight of the crop—for example: 5lb. turnips, at 9 inches asunder, give a crop of 57 tons 12 cwt., whereas the same weight of turnips at 11 inches apart, gives a crop of 10 tons less."

I do not further trespass upon the *Book of the Farm*, as the above extracts will suffice to prove some most important facts; but I put the question to the common sense of any candid inquirer, what can be the use of following up the dissatisfactory system of broad-cast sowings, which terminate in failures year after year, and in leaving unsightly waste blanks and patches, in breadths that, after all, do not produce a crop of 10 tons per acre? If the farmers of South Britain are content so to trifle with their leading root-crops, they must be left to purchase wisdom by sad experience. In the meantime, I am in a position to state, from observation during the late beautiful but trying summer, that, by the substitution of *kohl-rabi*, or cabbage-turnip, acres are now richly and *evenly* covered with this enduring, most hardy, and prolific vegetable, notwithstanding the Swedes and white turnips of a hundred fields are so miserably weak and patchy, that one might safely infer the crop of the *kohl* upon a single acre (growing as it is in rows 27 inches apart, the plants at least 12 inches asunder), to rival in cattle food the total bulk of turnips now existing upon 50 acres.

Kohl-rabi is sown in spring, in long drills by the side of a field: say two or three rows of the white bulbed, and as many of the purple variety. The ground is hoed and kept clean. In June the seedlings are partially removed to manured land, and planted by dibble on ridges at the distances above named. A shower

suffices to fix them, and on they grow as open "greens" till the process of bulbing commences. Then the collar at the base of the leaves enlarges, and gradually assumes the figure of an oblate bulb (with four opposite leaves at its sides), supported by a pedestal stem, so hard and fibrous as to bid defiance to any grub. In 1837 our turnips were so mangled and honeycombed by a grey caterpillar that they became worthless, and many persons substituted kohl, but relinquished it too speedily, returning to their "playing at" turnips. The kohl of this year I have found to resist the utmost drought of our most arid summer; and about September, when the wheat-lands received the first scanty showers, the stubbles were twice or three times ploughed, manured, and thoroughly harrowed; upon ground so prepared, the late crop of seedling kohl was set by dibble, but the plants nearer to each other in the rows. So dry was the season, that before ten acres of one noble field could be planted, six weeks had elapsed; yet all are now flourishing, and will come in for spring food. The most delightful and benign rains of October scarcely excited the miserable turnips, yet every plant of the kohl felt their influence, and is progressing to perfection. This fine vegetable, therefore, being proof against aridity, moisture, or frost, and defying insect ravage, is earnestly recommended as a substitute in those localities where the weak and miffy turnip is ever a subject of doubt and perplexity. As *clover lea* frequently precedes wheat in the rotation, and but too commonly is a harbour for that pestilent larva of Elater or click-beetle called *wire-worm*, I suggest that potatoes, now convalescent, intervene, after a thorough ploughing and preparation with soot, old lime screenings, and soda-ash. The last, a chemical compound product of the coal works, is stated to be a powerful remedy for the grub; and at all events these saline carbonous manures are congenial with the tubers and their haulm. The land, if not cloddy and binding, ought to produce from 10 to 12 tons per acre (Knight carried his estimates far higher); and now, as we have felt and proved the loss and value of this vegetable, we ought, with grateful care, to recur to it as a rotation crop.

Since my last article went to press, a letter reached me from a clergyman in Essex, who has for some years devoted his zealous attention to the radical improvement of agriculture. At its closing paragraph, I met with the following remarkable statement, which I now copy:—"Last year I drilled my wheat with 2¾ pecks per acre; at 60s. per quarter, the crop is worth upwards of L.18 an acre. This year (1847) I shall do the *same* land again with *one* peck per acre; which will be *three crops of wheat* in four years; and I do not fear the result." (September 22.)

This re-cropping of wheat year after year, and the amazingly

low seeding proposed, staggered me; and I took an early opportunity to address the reverend writer. I shall soon have occasion to note his rejoinder; but previously quote the following lines from a *Lecture on Manures*, by Mr Alfred Gyde, of Painswick.

"From personal knowledge of the greatly increased amount of corn which has been raised within the last few years on land that for years before was supposed to be yielding a maximum produce, and from the fact that some lands are returning sixty bushels of corn per acre, when soils situated on the same geological formation, and of nearly similar chemical composition, are not yielding more than *a third* of that amount, and of which, by a judicious application of skill and capital, the produce may at least be doubled, I feel justified in stating that the whole produce of this kingdom may be raised at least one third, or from 26 bushels per acre—which is the average of the kingdom, if Mr M'Culloch be correct—to from 34 to 36 bushels."

Mr Mechi has testified in a letter to me, of date September 8th last—that he had harvested between 6 and 7 quarters of wheat. I now recur to my Essex correspondent, who, in reply to my application, says (October 12), "In reference—I will observe that full 6½ quarters per acre grew on my land; but with respect to a repetition of wheat on the same land, I ought to have informed you that I intend it as a *trial* only; I do not recommend wheat after wheat, or especially so often as three times in four years; but I wish to make the experiment this year. There is no local peculiarity in my land, nor is it the *best* kind of land, but of a middling kind; but you remember, that where *I* have *one* plant feeding on the pabula of my land, others have at least six to ten.

"Reason, then, from analogy, and put from six to ten pigs in a stye instead of one, and see which will eat up a given quantity of food the sooner. *Thin sowing* looks wretched to farmers during winter and spring; but as harvest approaches, the thick has exhausted the soil, and the plant ripens before it arrives at maturity. But the thin is abundantly supported to the last. Last year a neighbour drilled 2 bushels an acre on the same day that I drilled 2½ pecks, or little more: his was ripe a week or nine days before mine; but ten of the best of my ears of ripe wheat weighed down 30 of the best of his—he chose his and I chose mine: his land was exhausted, mine was not, and this is an index to the whole matter. Therefore *I aim not to exhaust*. The common plan is a continued series of exhaustings and repletions. Again, farmers boast of the quantity of straw: I boast of nothing but plump grains to fill the bushel; the more straw the more exhaustion, and *vice versa*. I aim at growing as much whea as possible, with as little straw as possible. This year I had too much straw; my crop was too thick."

I have dealt freely with this letter, because I feel that there is a bold originality in the writer's conception. He is a champion among the thin-sowers—one determined to elicit truth; and I shall feel it a duty to consult his authority, and maintain his respected correspondence.

But whether by thick or thin sowings—in good or inferior land—the all-important question suggests itself—How, as a *general* result, are crops so great, so remunerative, so inestimable as a national blessing, to be obtained and secured? The answer is clear and definite—namely, that "a consummation so devoutly to be wished" can only be effected by a total and radical reform of the system of agriculture. By the term *system* I do not include the courses of rotation or cropping, for these are more or less arbitrary, and must be governed by local peculiarities. But that a new arrangement of the land, removal of all waste and injurious hedgerows, and patches of weeds and wild shrubs, must be effected, and also a regular laying out of the fields into squares or oblongs, few can be so hardy as to deny. Sir John Sinclair, in his Code, has, if I mistake not, given several plans of 10 and 20 acre pieces, which combine every facility. Land is lost to the extent of thousands of acres by inclosures, by irregular winding brooks and fences, which prevent the operation of the plough, shelter vermin, and promote the growth of vile intrusive rubbish. Herein, and for other important objects, the combined energy of landlord and tenant must be brought into action; good feeling, and the best interests of the country, require this coalition. Then, the land being laid out upon available principles, *drainage* must be adopted wherever the removal of water is indicated. In perusing *The Natural History of Selborne*, in Hampshire, by that excellent naturalist, the late Gilbert White, I met with the following passage, which is perfectly relevant, and may throw some light upon the theory of springy lands. "The land-springs, which we call *levants*, break out much on the downs of Sussex, Hampshire, and Wiltshire. The country people say, when the levants rise, corn will always be dear; meaning that when the earth is so glutted with water, as to send forth springs on the downs and uplands, that the corn-vales must be drowned; and so it has proved for these ten or eleven years past; for land-springs have never obtained more since the memory of man than during that period; nor has there been known a greater scarcity of all sorts of grain, considering the great improvements of modern husbandry. Such a run of wet seasons a century or two ago would, I am persuaded, have occasioned a famine. Therefore, pamphlets and newspaper letters, that talk of combinations, tend to inflame and mislead, since we must not expect plenty till Providence sends us more favourable seasons."—*Anno* 1774.

Here we have plain demonstration of underground water aggravated by rains: *drainage* was little thought of seventy years ago; but had it been so, and brought into thorough action, those *levants* of the south downs, and their neighbouring arable lands, would not have inundated the surface. One remark more —we require no *levants;* for the reader may be assured that *wherever*, after spring ploughing, the land shows, when the sun shines, patches of colour, here pale, there darker, *there* underground water prevails, and drains are required. Next in importance to drainage is, the deep laboration of the land, to break up and destroy the pan, if any exist, and effectually to comminute the sub-soil. We are but too apt to overlook and undervalue sub-soils; but these are in fact in numberless instances the storehouses of those alkaline silicates which yield potash to the plants, under the influence of air and superadded quicklime. No one can overrate the importance of deep tillage, for by it, land of the most degraded natural quality has been brought into a condition to yield, permanently, 36 bushels or more of wheat per acre, and other crops in proportion.

Manure is of vital importance, and as expenditure is worthy of consideration, I would observe, that the British farmer should save and store up every atom of available material that can be reduced by formation, in order to avoid the great outlay attendant on *guano.* By collecting the analytic evidences of several chemists, and comparing these with my own long-continued experiments, I am certified that the samples and qualities of that substance vary to such a degree as to render every purchase doubtful. Good sound guano of Peru or Bolivia comprises— first, as its *dry* basis, from 16 per cent or upwards of bone-earth (phosphate of lime) in a state of extremely fine division: hence its value for turnips. It also contains phosphates of ammonia, ammonia-phosphate of magnesia, sulphates and muriates, with saline bases, oxalate of ammonia, and a quantity of azotised organic matter; but of all these the proportions are doubtful. Now, then, were all the night-soil of the farm offices and steading mixed with earth from time to time, and in addition were layers of old thatch or straw, parings of ditches, weeds, &c., placed upon such earth, and soaked with all the urinous liquids of the premises, what a mass would be produced, and be continually forming! We have heard much concerning *liquid manure*, but from all I have seen and experienced, cow-wash and similar fluids, poured over grass or vegetables, invariably scorch, and are productive of no beneficial results whatsoever. They must be blended with earth, or with any vegetable refuse reducible by putrefactive fermentation.

"Of the value of liquid excretions of animals," observed Mr

Gyde in the lecture before named, "few farmers are at all aware, or more attention would be paid by them to their preservation. It has been found by direct experiments that a single cow voids in her urine, in the course of one year, no less than 900 lbs. of solid dry saline and organic matter, which is fully equal in fertilising power to the best Peruvian guano, and which, if carefully fermented, will yield 226 lbs. of ammonia. Now, if this 900 lbs. be of the same value as guano—*i. e.* L.10 per ton—then the urine of each cow will be worth, annually, L.4, and capable of highly manuring at least 2½ acres of land." If this manure be wasted at home, "the farmer is probably expending its worth in the purchase of bones and guano—manures which are incapable of supplying the place of the urine, since they are nearly wanting in potash, soda, and salts, while the urine of 20 cows contains 7400 lbs. of these."

Mr Gyde, however correct in his general inferences, errs in respect to *good* guano, which unquestionably is rich in salts: nevertheless, we possess at home abundant stores of all efficient fertilisers; and, therefore, as a closing remark, I beg to impress upon the reader, whether he be a large farmer or the occupier of a small domestic homestead, the urgent duty of saving every refuse matter of the house, the stable, cow stall, or piggery. His labour will then be amply repaid, and his return abundant.

Waste of Food in Fatting Cattle, &c.—So trifling is the interest that we take in the present rage for exhibitions of fat cattle, that we might be supposed to be disqualified, by this very assertion, to offer observations on the subject; but it is because but little judgment is shown, and so much wasteful error is committed, that we would draw attention to the evil, although we may acknowledge ourselves disqualified to enter the lists with breeders and fatters of kine and swine.

We have for some years past been so much disgusted with the rank, melting, oily state of the flesh of "show beasts," that it never is allowed to come to our table during the mania which pervades society about Christmas time, and while the Baker Street Bazaar extravaganza in London is being exhibited to the gaping public.

Waste of food is essentially wrong; it therefore becomes a duty for all those who look on and grieve over the folly of "fatters," to point it out to those owners of stock whose intellects are too obtuse to discover for themselves the monstrous and unqualified mischief they are committing. It is a trite axiom, "Enough is as good as a feast;" yet, in the very face of a truism, in which so much is conveyed, our magnates of the land, our dilettante breeders and farmers persist in gorging the creatures intended

for our sustenance, to the very verge of that state in which they become unfit for food.

"There is but one step from the sublime to the ridiculous;" and of a truth a beast stuffed to repletion, and wearying under a cumbrous load of bloated fatness, has taken that step—that last step in its "ill-regulated life," and is henceforth a scandal to its feeders, and a thing to be eschewed by all who have the fears of indigestion before them. One of the causes of the increase of illness during the Christmas consumption of show and prize animals, is doubtless to be attributed to the undue quantity of fat in a rank unnatural state, which is at that season especially taken into the stomachs of the fond public. Chemistry, with its glorious powers of investigation, has shown the nature of fat, and its operation on the human frame; yet, in the face of its incontrovertible truths, this silly public crowds to the bestial shows in gaping spurious delight, and gloats over future feasts of a nature so rank, that the gorge of an Esquïmaux would rise at them.

Cattle-shows were instituted, as every one is aware, ostensibly to submit the finest specimens of domesticated animals to the view of judges to improve our breeds of stock, and to excite emulation. The origin of all institutions is good—alloy is introduced by degrees; and in the course of time the cupidity and other bad passions of man supervene, and excellence becomes merged in corruption. We unhesitatingly assert, that cattle-shows, in their present degenerated condition, have arrived at this state; and ought to be, if not abolished, so altered and remodelled, that an entirely new order of things should be instituted.

That man must be a sorry physiologist who can suppose that fat constitutes health; that the genus alderman is a specimen of physical vigour; that the flesh (muscle) of an over-fatted animal (however the coarse feeder may doat over the marbling of a prize sirloin) can be in fit state for human food. Excess of fat is disease. The present aim of the race of fatters appears to be to produce the greatest quantity of tallow, the largest amount of dripping, and to establish themselves the kitchen-maids' best friends.

They who undertake the difficult and onerous duty of preparing stock for the food of man, ought to be able to bring to the task powers of mind of no common order. Any one can gorge a creature, but few can calculate the exact proportion of food at each meal to lay the largest portion of healthy flesh upon the bones of animals *short of repletion*, which is a state that should never be attained by man or beast; by the former, because his mental and bodily vigour would suffer; and by the cattle in his

byre, because their comfort would be compromised and their value lessened.*

The Cause of the Potato Disease, and its Cure. By MR JAMES MACARA, W. S., Edinburgh. — There has been much investigation, and not a little written on the subject of the potato disease, but as yet without any proper satisfaction having been obtained; indeed, the inquiry seems to be almost given up as hopeless. It may then appear bold in me to say that I have been enabled to discover the causes of the disease, and, as a consequence, its cure; yet I feel confident in stating this, and I am fortified in it by the almost unanimous assent of all the agriculturists, some of them of the first standing, to whom I have communicated my views upon the subject. The solution of the matter is simply this. The nature and uses of manure have hitherto been misunderstood—manure has been considered as merely or chiefly a nutriment, whilst it is properly a dissolvent and purgative; and by an excessive application of it to potato ground and potatoes, the latter have become so emaciated and enfeebled, that they are unable to stand ordinary, at least any degree of severe or unwholesome weather, and, like the human or animal frame in similar circumstances, have become subject to disease.

In considering this matter, then, it will be necessary first to advert more fully to the nature and uses of manure. It is hardly necessary to show that manure has hitherto been considered as nutriment. This is the general idea of agriculturists, and runs through the essays and writings on the subject. The celebrated Liebig speaks generally of manure laid on the ground as a restorative of the substances taken out of it by the crop—and (*Organic Chemistry of Agriculture*, p. 201) he attributes the whole increase of growth in a superabundant crop to manure; and yet (p. 197) he says that "we do not know what manure is."

Having a strong desire to get a satisfactory view as to the nature

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* With the exception of the Smithfield Club, we believe no agricultural society now bestows premiums for and therefore encourages the exhibition of over-fed oxen. The Highland and Agricultural Society relinquished the practice many years ago; and now that the capabilities of our native breeds of cattle and sheep to become fat, absolutely and comparatively, have been proved to demonstration, there seems no use of wasting time and food merely to ascertain to what degree particular animals may be overloaded with superabundant fat. The objections to over-fattening suggest a comparison of the fitness of byres and hammels, that is, confined houses, and small open courts with sheds, for fattening oxen in. In byres the animals must take the food as it is given them, in quantity and in time, and when under constraint it is quite possible for them to feel hunger at one time and be filled to repletion at another; while in hammels, the animals being free to choose both their food and the time when it should be eaten, eat and rest as it suits their inclination, and no animal that has its food at command will eat to repletion.—EDITOR.

and uses of manure, I studied the subject much, and at length, on reading a passage in a great author (*Swedenborg*), I found a key to the solution of the question, and, on further study, at length to the solution of the question of the cause of the potato disease, and its cure. That author (*Arcana Cœlestia*, No. 1103), in illustration of another subject he is treating of, says, that "every part of the human body is bound to yield some use, even those parts which are in themselves of small account, as humours, that are in themselves excrementitious, such as the salival and bilious humours, and the like, which not only are useful in digesting the food, but also in *separating what is excrementitious, and purging the intestines; the case is similar in respect to filth and dung laid on fields and in vineyards*, and so in divers other instances."

On consideration I think it may appear that there can be little or no nutriment in common manures, which are just the excrements, after what serves for nutriment to the body has been extracted; and the more putrid the manure is, the better. Fœtid urine is an excellent manure, but applied in any quantity to vegetables, it destroys them; as in the same manner nothing grows upon a dunghill composed entirely of excrements. When we consider the small quantities used, of guano and bone dust, with so great effect, and the substances of these manures, it is evident that the result is not from any thing nutritious in them. But salt is found to be one of the best of manures, and surely not from any thing in it that is of a nutritious nature. There is undoubtedly an analogy, as stated by the great author quoted, between the human body and the ground or earth, and the operations in each; and certainly no one conceives that a dose of salts of itself affords any nutriment; but the salts separate, and carry off vicious matter in the body, and then the body receives and incorporates with effect nutritious matter otherwise.

There are, it appears to me, two great laws in relation to this subject operating in all creation: the first, that like conjoins itself with its like; and the second, that what is evil or inferior passes or is driven from the centre to the circumference or external parts. The first of these is the principal or leading doctrine of the Homœopathists in relation to the cure of human disease, and the analogy must hold as to operations in the earth and its vegetable productions. Manure, it would appear, acts in the earth as in some measure a dissolving agent, and conjoins itself with the vicious separated particles; and then the second law comes more effectually into operation, by which these particles, so conjoined, pass or are driven to the circumference for renovation. It is well known that in the human body bad matter is in various ways, on a cure, driven off to the circumference or externals; and the analogy must hold also—indeed the same law operates—as to the ground and its productions.

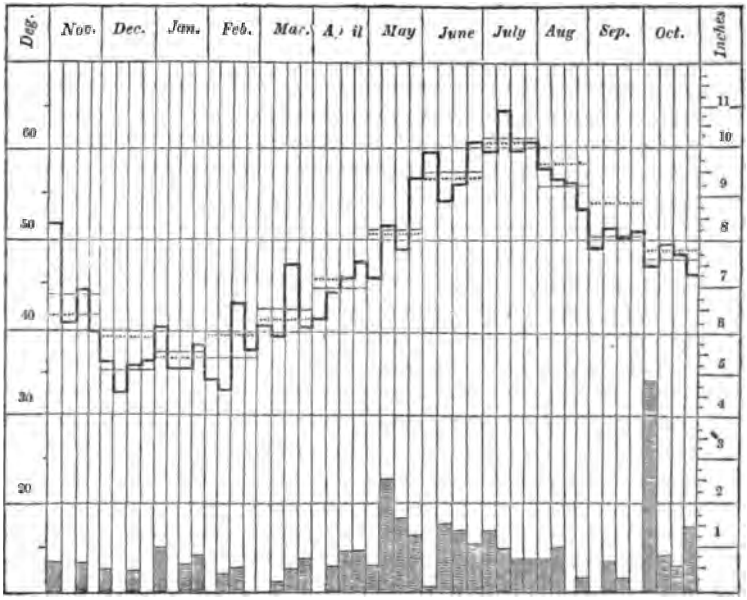
So much for the principle and uses of manures. I now come to the question of the potato disease, as arising from the application of manures. I must here also resort in theory to the analogy of the ground, and its productions, to the human body. Every one knows that the too frequent use of purgative medicines, or over-purgation in any way, emaciates and enfeebles the human frame, and makes it particularly susceptible of diseases from severe or unwholesome weather; and we know also that the enfeebled constitutions of parents and ancestors are inherited by their children and descendants. So it is also with plants and vegetables. It has been the constant practice for many years to manure potato ground, and very often the manure is put in the drill upon the potato seed. Now, although manures are useful when applied to a certain extent, and may have been found peculiarly so in potato crops, yet, on the principle stated, by continual application of them, and particularly of late years, in which there has been such an abundance of guano and other manures imported, the potato plant has generally degenerated. It has been perceived to be in a degenerating state for several years past, but the seasons being comparatively fine, till three years ago, the crops generally got through. The seasons 1845 and 1846 being particularly severe and unwholesome, disease became general and disastrous. This last season, 1847, was mild and fine, and accordingly the potatoes planted have generally escaped disease.

There are many facts well known that go to confirm the foregoing theory—particularly that disease has prevailed most in gardens and in grounds much manured; although an invariable rule cannot be here stated, as the particular susceptibility to disease may have existed from the degenerate state of the plants, or the contrary; and some variations in the results must also have arisen according to exposure to severe or untoward weather. With the exceptions, however, which, if traced out, may be found to have arisen from these causes, it is believed that the rule will be found of universal application. I know of a case in the immediate neighbourhood of Edinburgh, where one drill, or rather part of it, being thickly manured, the crop altogether failed, whilst the drills around it, thinly manured, came to maturity—an excellent crop. There are many other proofs, well known, of a similar nature.

Such being the cause of the disease of the potatoes, the cure or prevention of it is obvious, viz. to manure them less—nay, for a season or two, till they acquire new vigour, and perhaps occasionally thereafter, to give them no manure at all.*

* The author then goes into a disquisition on the causes of favourable and unfavourable seasons to vegetation and health; but as this part of the article is in our opinion of a nature rather transcendental than agricultural, we have declined to insert it.—EDITOR.

Mean of Temperature and fall of Rain for the Agricultural Season ending with October 1847.—From observations made at Annat Cottage, Perthshire; N. Lat. 55° 56′; elevation above the level of the sea, 170 feet.



The heavy zigzag line indicates the weekly averages of temperature.

The black lines partially cutting the lines of the month, show the monthly averages of temperature.

The dotted lines parallel to these last black lines, and above or below them, indicate the mean temperature for each month, on a cycle of years.

The weekly fall of rain is shown by the shaded portions at the bottom of the table, and bears reference to the scale of inches in the right hand column.

The horizontal lines crossing the table separate spaces of ten degrees of Fahrenheit's thermometer, and so graduated on the left hand column.

Mean temperature for the year = 47·1°, or ½ a degree under the cyclican mean.

Fall of rain 35 inches, a maximum depth, and remarkable as occurring in such a dry season. But when we deduct 13 inches, the depth for May and October, the average fall for the ten months is more in accordance with what the general character of the season was—one of dryness.

ANNUAL AGRICULTURAL REPORT.

January 1848.

The withdrawal of the usual Agricultural Report from the latter numbers of the Journal, may have been observed by some of our readers. The omission in one or two instances was occasioned from want of space; a contribution from a correspondent being supposed to possess more interest than any lucubration of ours; and we were rather glad as otherwise of an excuse for the occasional omission of the report, inasmuch as, having to speak of the same subjects—the state of the weather and of the crops—in the course of every successive quarter, the reports could not fail to bear a character of monotony. Having always to dilate on the same subjects, we think an agricultural report will prove more useful when it takes a review of the state of the weather, and of farming operations and their results, once for the whole agricultural year than more frequently. We propose beginning the annual reports now in January 1848, but this one will want that completeness which we would wish them all to possess, on account of our not having taken notes in time of all the occurrences and events which may be expected to be noticed in such a retrospect. Such a document, when complete, which it will be next year, appearing annually, will contain a useful record of agricultural practice, and constitute, we hope, a new feature in agricultural literature.

The atmosphere, during the entire winter of 1846, may be characterised as frosty, not assuming much severity, but displaying much constancy. We rather think the same characteristic may be traced in it throughout the succeeding summer and autumn; north and north-west winds then having much prevailed; and at whatever time the hot weather ceased, the air felt exceedingly keen and piercing. The accounts brought by the ships engaged in the whale fishing, assuring us that the Arctic ocean was more than usually covered with ice this summer, satisfactorily explain the cold state of the air and the prevalence of northerly winds. As might be expected, the frosty air in winter was dry and healthy, and comparatively calm.

The effect of a dry frosty air in winter is to pulverise the soil to the finest state; and, in consequence, the soil last winter was more thoroughly and generally pulverised than it has been for many years past; and perhaps it never gave less trouble in the working, or ever was in a better state for receiving the seed than in last spring. So much rain had fallen in the autumn of 1846 as to prevent the sowing of winter wheat in the strongest class of

soil, both upon the fallow and potato ground; but as the previous damp state of this sort of ground only enabled the dry frost to act upon it as a pulveriser the more effectually, the ground was in the most favourable state for receiving spring-wheat, and, in consequence, we believe, a greater breadth of it was never sown in any spring than that of 1847. All spring-sown crops—spring-wheat, beans, oats, and barley—were thus placed in the most pulverised and finest bed, and the bean land, in particular, was manured in the best possible condition.

The proportions between the different crops was unusually disturbed, in consequence of some peculiar circumstances. The wet autumn curtailed the extent of the autumnal wheat; the dry winter and spring filled up the deficiency with spring-wheat. The dry state of the ground in early spring induced an increased extent of bean culture, in preference to the chance of loss by the potato crop, the usual quantity of which could not be planted at all events for want of seed.

The germination of all the spring-sown crops was not alike good. The beans germinated quickly, and the plants grew vigorously. The spring-wheat indicated equal vigour. The oats came through the ground in patches and in a sickly state. The barley was bold and not over-thick. The cause of this inequality was no doubt to be ascribed to the drought which prevailed throughout the spring. Beans and wheat always thrive in dry weather, in the early period of their growth. Oats require moisture at all times, and when deprived of it at the period of germination, never fail to come up blanky, or to escape the attacks of the grub—the larva of that elegant insect the *Tipula oleracea*. Barley can withstand drought for a considerable time.

The almost total destruction of the potato crop of 1846 left very few for consumption, and still fewer for seed, in the spring of 1847; and the consequence was an unprecedented limitation of its culture. Sufficient rain had fallen prior to the period of its planting, so that the sets were placed into the ground when in the most favourable state, and the plants came up and continued to grow without interruption, and in promising condition.

The same rain rendered the ground in a very favourable state for the reception of the turnip seed, and there are few seasons in which its germination was effected so quickly and vigorously.

The same rain, also, with occasional subsequent showers, secured an abundant crop of hay. The artificial grasses were converted into hay in the best state, with little interruption from rain; but the meadow hay was somewhat damaged by the subsequent damp state of the atmosphere.

The pasture grasses did not fare so well as those for hay. What had been eaten early, suffered by the drought, and assumed

at once the decayed hue of autumn, and never recovered its green colour even when showers fell, so that every sort of beast were stinted in pasturage all summer. The dry spring, on the other hand, encouraged the hill pasture, the thick early coating of which kept out the drought, and afforded abundance of food through the whole season.

The heat was intense during the greater part of summer, and was very generally diffused over Europe. When the wind blew at any time, the air felt excessively keen, very much of a frosty character, even accompanied with sunshine, and was in fact unseasonable, but the nights on those occasions were less keen than the days. The idea suggested by the feeling was, that were it not for the presence of the sun, the frost would actually be manifested in ice.

The heat constituted a drought, for less than the usual quantity of rain fell for months; and when even a heavy shower occasionally made its appearance, its effects soon disappeared. The most decided evidence of the drought was its effects upon every species of crop.

The pasture continued bare. The oats were not only blanky, but tufty and of a bad colour. The barley was stinted in growth, and running to seed. The beans stopt growing in the straw, and threw out a great profusion of blossoms. The turnips, though regular and healthy, ceased to enlarge their leaves. The potatoes continued to grow, had a healthy aspect, but gave evident symptoms of early maturity. The wheat was the only crop which did not seem to suffer, but even it also evinced symptoms of earlier maturity than was desired

The heat and drought continued until the crop was ripened, cut down, and housed. Many cut down their crops without a shower, and few were troubled with rain during the entire period of harvest. That period was of very short duration. In all such seasons no time is lost at harvest work; and as the days were almost at their longest, much work was executed for the cost of wages. In all such seasons, too, the crop is gathered into the yard in the best condition.

The effect of the summer was various upon the different crops. The wheat was good, but not so fine in quality as might have been expected from the heat of the season, for it is understood that wheat can withstand the greatest heat and drought experienced in the temperate regions. Its failure in high quality may be accounted for in this manner:—In May the heat for some days was very intense, and this just before the wheat came into bloom. Vegetation then received a slight check. A considerable quantity of rain, upwards of two inches, fell immediately after, and the heat increasing, vegetation was pushed on at a rapid

pace. The rapid check, followed by quick vegetation, had no doubt injured the growth of the plant, and the showery weather accompanying the season of bloom, had also affected the simultaneous impregnation of all parts of the ear. In the earliest parts of the country, such as the south of England, the heat had not made its appearance too soon for the state of the crop, and the consequence was, that there the grain was of fine quality and prolific; but in the later parts it rather wanted quality, though the yield was good. On the whole, the crop was superior to that of last year, both in quality and quantity.

The season had suited the nature of barley to a remarkable degree, for that grain everywhere was abundant and fine—much superior than for several years past.

The oats never recovered from the first check at germination, and the consequence was much inequality in the crop. In the best and earliest districts the straw was unequal in length, and did by no means stand thick in the ground. In the later districts, the crop was altogether better. On looking across several fields of oats, and observing here and there tall stems supporting large and full heads of corn, it occurred to us that this was a season for selecting such superior heads, with a view of obtaining a newer and hardier variety of oat than we possess. Since the tall heads had escaped the untoward circumstances attending the germination of the seed, and the unfavourable state of the weather for the subsequent growth of the plant, it is not unlikely but that they attained their superiority by possessing a more vigorous constitution than the varieties most commonly in use; but whether the fact be as now conjectured, it is always sound policy to secure every plant suited to field culture that manifests a superior quality in any manner or degree to those we at present possess.

In the lighter soils, the drought had checked the growth or the straw of the beans, but in deep true bean land the straw grew to an extraordinary length, and the yield in every case, we believe, will be found to be very great. Since the oats are a short crop, and the beans an abundant one, and therefore will not be costly, the horses on farms will probably fare well this season. The straw of itself, which was secured in the finest order, is equal to hay in the feeding of horses; and cattle, especially young ones, are remarkably fond of the chaff of beans. In these circumstances, the hay may be, or may have been, all disposed of, on farms suited to the growth of beans.

The potato disease seems to have almost deserted the fields this season. With the exception of a few patches in fields which seemed to be affected with the disease in England, we should say the crop had certainly escaped the malady. The excellent

seed-bed, and the subsequent dry summer, may have contributed to this end; for the crop came to maturity, indicated by the gradual decay of the stems, as long as the weather continued dry and warm. Farmers possessed so very little seed, that more than two acres of crop were scarcely to be seen on any farm, though some had the courage to purchase seed at a high rate, and venture on an extended cultivation, in the hope that if the crop escaped disease, the potato would be in such demand for the table as to realise very high prices. And, it must be owned, many such speculators succeeded, especially those whose crops were ready for market before the fall of rain in October; and these disposed of them, at exorbitant prices, as fast as they could be taken out of the ground. We have heard of several farmers having realised upwards of L.50 the Scotch acre. The quality of the crop is very fine, and in flavour resembles very much the potato of old. The later potatoes seem to have been injured by the rain in October, which would no doubt induce a late or recent growth in them, and these showed symptoms of disease after being pitted, and in some instances a large proportion perished in the pit.

The continued drought of summer gave a serious check to the growth of the turnip; so much so, that at the end of harvest it was apprehended the crop would not attain maturity. The rains of October, however, soon showed that the languid vegetation of the plant was occasioned by no disease, but was solely the effect of drought; for no sooner did the crop receive moisture, than it increased in bulk at a rate beyond experience. There cannot be a doubt that the benign rains of October caused an increase in the turnip crop throughout the country to the amount of millions of tons. In ordinary circumstances, even, it is surprising how rapidly the turnip enlarges its bulb in the month of October; but when water, essential to its enlargement, is presented to it in an opportune season, after a privation of many weeks, the parched plant appropriates it to its use with a rapidity resembling the eagerness of the fainting traveller, who slakes his burning thirst at the first spring he meets with. The benign rain secured the crop for Scotland, though it came, perhaps, too late to confer a similar benefit on the south of England.

We have heard of several instances of the appearance of the disease in turnips commonly called "fingers and toes." The drought no doubt had confirmed the disease in plants predisposed to it. This disease has not appeared for many years, but its recurrence should be a warning to us to be on our guard against its increase. About fifty years ago, the county of Roxburgh was much troubled with this disease; so much so, that many farmers

lost their entire crop by it. It was suggested that liming the land would put a stop to it, and a few farmers applied lime; the county being distantly situate from the site of that useful mineral, they were the more willing to give the experiment a fair trial. A very few cases in a very few years afforded sufficient evidence of the efficacy of lime in effecting a cure; so when the county was generally limed, at much trouble and expense, the disease altogether disappeared. On reconsidering these facts, it may be worth the while inquiring, whether the soil in which the recent cases of disease have actually been experienced, has been limed at all, or recently, and in what quantities?

The rains falling so late as October, could not be expected to recover the pastures, which had remained in a parched state all summer, but they certainly brought them back to their green colour; and they also encouraged the growth of the young grass amongst the stubble, as well as supported the aftermath on the hills.

The great trysts at Falkirk were less abundantly supplied with stock than usual, excepting, perhaps, the last one in October, which presented as many sheep as ever. It was remarked that the whole hill stock this year—cattle and sheep—were in the very highest condition, owing to the full and fine pasture of the season.

The prices of every sort of stock had a declining tendency all the season. In summer, the bareness of the pasture was sufficient to account for the want of demand for lean stock; and the same cause would affect the prices of autumn, as those who usually fatten their stock on grass in summer, and purchase in autumn lean stock for fattening in winter, had to keep on their grazing cattle, taken off lean for want of grass, during the winter. The prospect of a declension in trade as the winter approached, and the dismissal of many hands from railway works, doubtless operated to lower the prices of lean stock, when no probability existed of their being required when fattened. For these reasons, the hands of the breeders and graziers are probably full for the winter, of the cattle they expected to dispose of during the summer and autumn; if so, the amendment of the turnip crop will yet be of great service to them, and especially when the prices of turnips are low, at least lower than they have been for some years past. The graziers have had a bad summer; and the only chance they have of being paid for their half-fat stock is to fatten them on turnips.

The phenomena presented by the corn markets the last twelvemonth have been of the most extraordinary description. As soon as it was ascertained that the crop of potatoes of 1846 had almost totally failed, and the grain crop was not so prolific as might be

desired, apprehension seized the public mind, that not onl there a deficiency of food in this country, but also a ge failure of the corn crops in Europe, so that we would ha obtain our supplies from America, where it was said the I corn at least was abundant. The apprehension increase learning that corn was prohibited being exported from Fr Spain, and Portugal, and that none was to spare from Bel Holland, Poland, and Russia. The consequences were the sacking of every granary in Europe, and the transmission of mited orders to the United States for every particle of grair flour they could send us. Meanwhile, the prices of grain ro a height in this country not experienced since the peace in 1 The panic of "famine" was, like all other panics, very mucl aggerated; and its consequence was to produce this anoma state of affairs, that, while grain was at least 80s. per quart Mark Lane, and millions of people were said to be at the p of starvation, wheat and flour were exporting in large quant every week to other countries—to France, Belgium, and Holl This latter fact clearly showed there was no want of food in country, else why allow it to be exported?

This season may be characterised as one of general prolific not merely in cereal grain, but in the production of all sorts of f and seeds; the fruit trees and bushes not only having yield superabundance of their treasures, but every forest tree also a profusion of blossom and seed. Such natural productions a in preserving the useful products of the fields to man, inasm as while the wild birds are supported upon the fruits and be of the forest, they have no inclination to feed upon the prod of the field. When fruit is plentiful, and it is then cheap, labouring people like to eat it; and certain kinds of fruit, suc apples, may be preserved in a wholesome state the greater of the winter. Such devices, however, are more commonly p tised by the labourer on the Continent than in this cour as he is accustomed to subsist on fruit for a portion of e year. The vintage has been pronounced very prolific of quan but the wine will be thin, wanting in body, and therefore unsu to the taste of this country.

TABLE OF PRICES, &c.

The Average Price of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Date.	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Rye. s.	d.	Pease. s.	d.	Beans. s.	d.
1847												
Sept. 4.	60	6	35	3	27	4	36	1	43	8	46	6
11.	53	7	35	3	26	4	36	0	45	10	47	0
18.	57	0	34	8	21	7	36	0	41	10	40	4
25.	53	2	33	5	25	5	37	0	47	11	39	3
Oct. 2.	57	9	34	7	25	3	36	7	46	5	40	3
9.	56	7	33	4	27	1	34	9	49	5	46	5
16.	54	8	31	8	24	8	37	0	53	1	41	2
23.	59	1	35	0	26	8	35	9	52	2	43	5
30.	56	9	34	6	24	2	39	0	54	11	42	11
Nov. 6.	54	0	34	7	25	3	35	0	53	5	40	9
13.	55	9	33	8	24	2	34	1	54	6	44	0
20.	57	2	34	0	24	7	34	2	59	0	43	9
27.	55	10	32	10	24	4	33	6	52	3	41	3

LIVERPOOL.

Date.	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Rye. s.	d.	Pease. s.	d.	Beans. s.	d.
1847.												
Sept. 4.	49	6	29	8	27	2	36	0	40	6	53	7
11.	50	4	26	6	24	1	36	4	39	4	48	1
18.	49	1	29	2	22	6	36	2	37	1	53	0
25.	52	2	29	9	25	3	36	8	40	0	37	4
Oct. 2.	55	2	30	4	23	6	37	2	42	6	40	4
9.	50	1	33	6	24	9	37	6	44	4	48	8
16.	49	6	35	2	24	7	38	0	45	4	48	10
23.	49	11	36	0	24	9	38	4	46	0	54	6
30.	49	1	34	8	22	10	38	8	46	6	50	0
Nov. 6.	48	4	35	0	21	2	35	6	47	2	47	2
13.	51	8	35	6	23	6	34	4	48	8	45	1
20	53	1	33	4	22	5	33	8	[illegible]	6	44	2
27.	53	6	31	10	22	11	32	6	53	4	44	6

EDINBURGH.

Date.	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Pease. s.	d.	Beans. s.	d.
1847.										
Sept. 1.	55	9	31	1	25	6	48	6	49	5
8.	53	4	31	9	26	0	47	0	47	7
15.	58	6	32	8	27	8	46	8	47	5
22.	61	2	33	6	29	11	46	10	47	11
29.	60	0	34	0	26	10	47	8	48	6
Oct. 6.	63	5	34	2	26	7	48	0	48	6
13.	62	0	34	1	28	1	46	0	46	8
20.	62	2	34	10	28	11	44	0	45	0
27.	60	4	33	0	27	3	43	0	43	6
Nov. 2.	62	2	31	5	26	0	42	0	42	4
9.	59	11	30	7	25	6	40	0	40	6
16.	57	3	31	6	26	2	38	0	38	4
23.	53	10	30	9	25	6	35	0	35	9

DUBLIN.

Date.	Wheat, p. barl. 20 st. s.	d.	Barley, p. barl. 16 st. s.	d.	Rye, p. barl. 16 st. s.	d.	Oats, p. barl. 14 st. s.	d.	Flour, p. barl. 9 st. s.	d.
1847.										
Sept. 3.	28	11	14	1	12	0	12	1	19	6
10.	26	3	12	9	11	9	12	4	19	0
17.	27	10	16	6	12	1	12	5	19	6
24.	29	3	15	9	11	11	12	6	20	6
Oct 2.	29	6	15	10	12	2	12	8	20	9
9.	30	2	15	6	12	6	12	4	20	4
16.	30	6	15	2	12	8	12	6	19	8
23.	29	10	16	4	13	4	12	8	19	6
30.	29	2	16	2	13	2	12	2	18	10
Nov. 5.	28	5	16	0	13	4	12	1	18	6
12.	29	8	15	7	13	10	12	2	18	6
19.	30	3	15	9	13	5	12	8	19	6
26.	29	2	16	5	14	0	12	2	18	0

TABLE showing the Weekly Average Price of GRAIN, made up in terms of 7th and 8th Geo. IV., c. 58, and 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties payable on FOREIGN CORN: the duties payable thereon, from September to December 1847.

Date.	Wheat. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty.	Barley. Weekly Average. s.	d	Aggreg. Average. s.	d.	Duty.	Oats. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty.	Rye. Weekly Average. s.	d.	Aggreg. Average. s	d.	Duty	Pease. Weekly Average. s.	d.	Aggreg. Average. s.	d	Duty.	Beans. Weekly Average. s.	d.	Aggreg. Average. s.	d	Duty.
1847.					Free					Free.					Free.					Free.					Free.					Free.
Sept. 4.	56	8	66	6	...	36	3	10	5	...	25	5	28	9	...	33	9	42	2	...	42	1	43	2	...	41	10	53	7	...
11.	51	4	62	2	...	33	1	38	5	...	24	7	27	9	...	32	4	38	1	...	43	2	42	8	...	47	7	52	5	...
18.	49	6	57	10	...	32	1	36	5	...	22	5	26	3	...	33	2	34	11	...	41	1	41	7	...	42	11	50	6	...
25.	53	6	55	8	...	31	10	35	0	...	23	0	25	3	...	35	2	34	1	...	44	4	41	10	...	42	5	48	0	...
Oct. 2.	56	9	54	8	...	32	0	33	10	...	23	1	24	3	...	33	3	33	9	...	44	2	42	5	...	43	7	46	11	...
9.	54	2	53	8	...	32	4	32	11	...	22	11	23	6	...	34	2	33	8	...	44	4	43	2	...	46	2	45	9	...
16.	54	3	53	3	...	32	6	32	3	...	22	7	23	1	...	33	0	33	6	...	45	4	43	9	...	46	3	44	10	...
23.	55	2	53	10	...	33	7	32	4	...	23	4	22	10	...	38	0	34	5	...	47	9	44	6	...	47	1	44	9	...
30.	53	6	54	7	...	33	6	32	7	...	23	1	23	0	...	33	4	34	6	...	50	10	46	2	...	46	0	45	3	...
Nov. 6.	52	4	54	4	...	31	9	32	9	...	23	0	23	0	...	34	1	34	4	...	49	4	47	0	...	46	6	45	11	...
13.	53	8	53	10	...	32	4	32	10	...	23	4	23	1	...	33	7	34	5	...	48	8	47	8	...	45	9	46	3	...
20.	54	3	53	9	...	32	0	32	9	...	22	11	23	0	...	32	10	34	2	...	49	0	48	5	...	45	11	46	2	...
27.	52	11	53	8	...	31	6	32	7	...	22	10	23	2	...	32	9	34	1	...	48	5	48	11	...	44	6	45	11	...

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1847.							
Sept	Danzig	45/ to 54/6	28/ to 35/6	20/ to 26/6	24/ to 30/	25/6 to 32/6	42/ to 48/
Oct.	...	43/ 52/6	24/6 32/	17/ 24/6	22/ 28/6	30/6 39/	38/6 45/
Nov.	...	42/6 53/	22/6 30/6	14/6 18/	20/6 26/6	28/6 36/6	35/ 40/
Sept.	Hamburg	46/6 56/6	27/ 35/	16/ 20/6	20/6 26/6	30/ 38/	36/ 43/
Oct.	...	42/6 50/	22/6 33/	14/6 17/6	18/6 25/	35/ 43/	33/ 40/
Nov.	...	45/ 53/	25/ 31/	15/ 18/	19/6 25/6	32/ 38/	30/ 36/6
Sept.	Bremen	40/6 48/6	26/6 35/	16/6 20/6	26/ 32/	36/ 42/	40/ 44/6
Oct.	...	48/6 55/	28/ 34/	14/6 18/6	24/ 26/6	34/ 43/	35/ 40/
Nov.	...	42/6 50/	22/6 32/	14/ 17/6	20/6 23/6	34/6 42/	33/ 40/
Sept.	Konigsberg	46/6 53/6	25/ 33/6	15/ 19/6	28/ 32/	27/9 36/6	40/ 46/
Oct.	...	42/6 50/	22/6 30/6	14/ 18/6	26/6 30/6	30/6 38/6	38/ 42/6
Nov.	...	36/6 46/	20/6 28/6	14/6 18/	24/ 30/	30/ 35/6	32/6 38/6

Freights from the Baltic have declined from 4/6 to 7/; and from the Mediterranean from 7/6 to 10/6 per qr.

THE REVENUE.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 10th of Oct. 1846 and 10th of Oct. 1847—showing the Increase and Decrease on each head thereof.

	Quarters ending Oct. 10.		Increase.	Decrease.	Years ending Oct. 10.		Increase.	Decrease.
	1846.	1847.			1846.	1847.		
	L.	L.	L.	L.	L.	L.	L.	L.
Customs	5,310,835	4,936,644	...	374,191	18,150,933	18,418,157	267,224	...
Excise	4,181,926	3,639,946	...	641,980	12,251,932	12,092,018	...	159,914
Stamps	1,774,364	1,707,945	...	66,419	6,983,129	7,135,378	152,249	...
Taxes	209,940	213,888	3,459	...	4,238,560	4,329,677	91,117	...
Post-Office	217,000	222,000	5,000	...	802,000	859,000	57,000	...
Miscellaneous .	222,910	73,126	...	149,784	371,045	269,837	...	201,208
Property Tax	1,972,128	1,918,645	...	53.483	5,332,157	5,443,453	106,296	...
	13,889,103	12,612,194	8,945	1,285,857	48.129,756	48,542,520	673,886	361,122
	Deduct Increase on the quarter			8,945	Deduct decrease on the year...............		361,122	
	Decrease on the qr....			1,276,912	Increase on the year		312,764	

PRICES OF BUTCHER-MEAT.

Date.	LONDON, Per Stone of 14 lb.		LIVERPOOL. Per Stone of 14 lb.		NEWCASTLE. Per Stone of 14 lb.		EDINBURGH. Per Stone of 14 lb.		GLASGO Per Stone of	
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	M
1847.										
Sept.	7/9 to 8/9	8/ to 9/	7/9 to 8/9	7/6 to 8/6	7/3 to 8/3	7/ to 7/9	7/6 to 8/	7/3 to 8/3	7/9 to 8/9	8/
Oct.	7/3 8/3	8/3 9/	7/6 8/	7/3 8/	7/ 8/	7/ 7/6	7/3 7/9	7/ 8/	7/6 8/6	7/9
Nov.	7/6 8/6	8/6 9/3	7/3 8/3	7/6 8/6	7/3 8/3	7/3 8/	7/3 8/	7/ 8/	7/6 8/9	7/3

PRICES of English and Scotch WOOL.

ENGLISH, per 14lbs.			SCOTCH, per 14lbs.		
Merino, ...	12/ to	15/	Leicester Hogg, ...	11/6 to	14/6
in grease, ...	8/6	12/	Ewe and Hogg,........................	8/6	13/
South Down,..................................	14/	16/6	Cheviot, white,............................	7/6	11/
Half Bred,......................................	10/6	15/6	Laid, washed..........................	5/6	8/6
Leicester Hogg, ...	10/6	14/	unwashed,..........................	4/6	7/6
Ewe and Hogg,........................	7/6	12/	Moor, white,................................	5/	7/
Locks,..	5/6	7/6	Laid, washed, ...	4/	5/6
Moor, ...	4/9	6/6	unwashed,..........................	3/	4/9

THE USE OF LIME IN AGRICULTURE.

No. II.

By Professor Johnston.

In the preceding part I have described all the natural forms in which lime is applied to the land, without previous preparation. The solid limestone rocks are more extensively employed in this country than any other form in which lime occurs; but they require the previous preparation of burning. In the present part, therefore, I shall treat of the different kinds of limestone, and the changes which they undergo when burned, slaked, and afterwards spread upon the land.

Section I.—*Of the different varieties of Limestone.*

There are four principal varieties of limestone found in our islands—chalk, nodular limestones, blue and black limestones, and magnesian limestones.

1°. *Chalk* is a white limestone, which in England is generally soft, porous, and earthy in its fracture, adheres to the tongue, and falls to pieces under the action of the winter's frost. It can, therefore, be laid upon the land without any previous preparation. In the north of Ireland, again, the chalk is hard, compact, and brittle. It scarcely absorbs any water, and is therefore unaffected by the frost. Before it can be used for any agricultural purpose, it must be burned in lime-kilns in the usual way.

Few analyses of different varieties of chalk, made with especial reference to their agricultural values, have hitherto been published. We are therefore as yet very imperfectly acquainted with the proportions, especially of sulphate and phosphate of lime, usually present in them. In a subsequent part I shall state all that we at present know in regard to the quantity of phosphate they contain.

The upper chalk abounds in flints, but the white chalk itself, in which the flints are imbedded, contains very little siliceous matter—often not more than half a per cent. The following analyses are among the best we yet possess of this variety of limestone:—

	Upper chalk of Meudon. Berthier.	Intermediate chalk of Maestricht.	White chalk marl. Osnabruck.	Gray chalk marl, of the Kromsberg.	near Rethen.*
Carbonate of lime	98·	96·5	26·	86·5	85·5
Carbonate of magnesia	1·	1·0	—	—	0·5
Alumina and oxide of iron	1·	0·5	7·	4·0	3·0
Silica	—	0·5	59·	5·5	6·0
Water	—	1·5	8·	4·0	5·0
	100·	100·	100·	100·	100·

It is not common in this country to find beds of chalk containing

* The four latter of these analyses are by Römer.

so much siliceous matter as that from Osnabruck, of which the composition is given in the third column of the above table. These analyses appear to show that the quantity of magnesia contained by the chalk rocks is usually small.

It has been shown by Ehrenberg that the chalk rocks are made up in large proportion of the remains of minute infusorial and other animals, such as those of which I have spoken when treating of the origin of beds of marl. It is probable, therefore, that all the chalks contain an appreciable quantity of phosphate of lime—which is present in all animals—but that this proportion will vary with the kind of animals from the remains of which it has in different localities been principally made up.

2°. *Nodular limestone.*—In some parts of England limestone occurs in rounded balls or nodules, scattered at intervals through a hardened rock of clay. In the lias clays of Whitby, Lyme Regis, and other places, they especially abound. When burned in kilns these nodules often refuse to fall to powder by slaking, in consequence of the large quantity of earthy matter they contain. When ground to powder, however, after burning, they quickly set, and make excellent cements, for which purpose they are chiefly employed. Three varieties of these nodules gave by analysis to Mr Phillips—

	Aberthaw.	Yorkshire.	Sheppy.
Carbonate of lime	86	62	66
Clay	11	34	32
	97	96	98

In other parts of the island, again—as in Morayshire, where the old-red sandstone forms the prevailing rock—nodular limestones occur, which are of a very fine quality, and burn into excellent lime. These are dug up wherever they are met with in sufficient quantity, and are burned for agricultural purposes. None of these nodular limestones of the old-red sandstone have yet been analysed, but from their abounding in the remains of fossil fishes, it is to be presumed that they will be comparatively rich in the valuable *phosphate* of lime.

3°. *Blue and black limestones.*—In Great Britain these limestones principally occur in the mountainous or hilly districts of Derby, York, Northumberland, Ayr, Fife, and the Lothians—but in Ireland they are found over the whole central part of the island. They compose what are usually called the mountain or carboniferous limestone beds.

These limestones are hard, compact, and brittle. They are generally blue in colour, but are sometimes black—as in the black marble of Derbyshire. They are usually loaded with, often entirely made up of, the remains of marine animals of considerable size. Some beds of great thickness appear to consist of one entire mass of shells of various kinds, others to be the work of coralline

insects—to be in fact ancient coral reefs. They owe their colour to a portion of the organic matter of those animals which still remains imbedded in the rock, and the colour varies in general with the proportion of this matter which they have retained.

Differing thus in the nature of the animal remains of which they consist, it is to be expected that they will differ considerably also in the relative proportions, especially of those substances of which only a small quantity is usually found in them.

Most of the analyses of these limestones, hitherto published, have been made with the view of determining only the per-centage of pure carbonate of lime and of earthy matter they contained, or of estimating the relative proportions of lime and magnesia. But the progress of scientific agriculture now demands a more rigorous procedure. The importance of the phosphate of lime being now understood, a more refined analysis of such limestones must hereafter be made, if their true agricultural value is to be determined. This makes the aid of a higher chemistry necessary to the farmer, since the rigorous determination of the very small proportion of phosphoric acid which these limestones usually contain, is a work of very considerable difficulty.

The following analyses of two blue limestones from the neighbourhood of Stanhope, in the county of Durham, were made with the view of determining the relative proportions of lime and magnesia which they respectively contained—

	LIMESTONE FROM STANHOPE.	
	Shelly variety.	Coralline variety.
Carbonate of lime	95·06	93·77
Carbonate of magnesia	2·46	0·37
Alumina and oxides of iron	1·00	3·87
Insoluble siliceous matter	1·32	1·59
	99·84	99·60

These are both rich limes—excellently adapted for agricultural purposes—containing only a small quantity of earthy matter, and not too large a proportion of magnesia. The per-centage of phosphate of lime was not sought for. We know, however, from the analyses of Silliman, that the recent corals contain the phosphates of lime and magnesia: there can be no doubt, therefore, that they are also present in the ancient corals preserved in these limestone rocks. In the absence of rigorous comparative analyses, therefore, we should expect that the coralline variety would be richer in phosphates than the shelly variety of these Stanhope and other mountain limestones.

The quantity of magnesia in these blue limestones varies very much. In the same quarry one bed of rock will be almost free from magnesia, in another a large per-centage will be found.

This variation in the proportion of magnesia in different limestones and in different beds appears in the following table, representing the composition of three Scottish limestones, of nearly the

same geological age—being under or among the coal measures respectively of Kinross and the Lothians, and of one limestone from the Hudson river, in the United States:—

	LIMESTONE OF BROXBURN. Upper bed.	Lower bed.	BLAIR-ADAM.	RONDONT, HUDSON.
Carbonate of lime	56·32	62·72	60·63	45·30
Lime, in state of silicate	0·18	0·83	—	—
Carbonate of magnesia	2·14	7·89	13·19	25·70
Oxides of iron	3·36	3·95	8·01	2·25
Soluble alumina	0·22	0·18	0·70	9·13
Alumina, in state of silicate	15·02	2·11	16·14	
Silica	21·08	20·13		15·37
Water	1·90	0·98	0·30	2·25
	100·22	98·79	98·97*	100

These limestones, from the large quantity of magnesia and earthy matter they contain, are well adapted for hydraulic limes—a purpose for which those of Broxburn are extensively employed. They contain too little lime to be reckoned among the best for agricultural purposes, and the large per-centage of magnesia in the Blair-Adam and Rondont limes, will prove an objection to their application in very large doses to the land.

The earthy matter varies very much in quantity, as is seen in the above analyses of the limestones from Broxburn. But in some beds it is so great that, when burned, the limestone refuses to fall to powder. The Irish *calp* is of this kind, and similar calcareous beds occur in various parts of the Mountain limestone and in the older Silurian rocks. Such beds of rock may be employed, like the nodular limestone of the lias clays, for the manufacture of cements and hydraulic mortars, but cannot be employed in the usual way for the improvement of the soil. There are many districts, however, in which such limestones might be cheaply crushed by means of water-power, and thus economically prepared for being laid upon the land.

4°. *Magnesian limestones.*—These limestones derive their name from the large proportion of magnesia they usually contain. In England they cover a narrow stripe of country, often hilly or high, running from north to south, and extending from near the city of Durham to the town of Nottingham. They are, in this country, generally of a yellow colour, often earthy in their fracture, sometimes soft and friable like marl. In these states they form bad building stones, but do not fall to pieces during the winter's frost and thaw. They cannot, therefore, be applied directly, like the chalk rocks, in liming the land.

When hard and brittle, these limestones are sometimes honeycombed, as at Sunderland, in the county of Durham, but are more usually studded with cavities of various sizes, the interiors of which

* The three Scottish limestones were analysed by my assistant, Dr Fromberg—the fourth by Professor Beck.

are lined with crystals, generally of carbonate of lime. In some localities, however, the rock occurs of a compact and crystalline structure, which enables it to withstand the action of the weather in a remarkable manner, and thus to unite most of the desirable qualities of a good and durable building stone. It is from a bed of magnesian limestone of this description in Yorkshire that the stones for the new Houses of Parliament are procured.

In this limestone comparatively few animal remains have hitherto been found. Shells occur only in a few places, of comparatively few species, and seldom in great numbers. Corals also are unfrequent, and in the county of Durham I have met with them only on a few of the higher hills of this formation. The most abundant locality for shells and corals is Humbledon Hill, near Sunderland, but even there they occur only over a limited space. This scarcity of organic remains may probably be attended in these limestones by a similar scarcity of the phosphate of lime, which is found always to increase in quantity with that of the remains of certain forms of animal life. No analyses, however, have been hitherto published, the results of which enable us to speak with any degree of confidence upon this point.

The magnesia, like the lime in these rocks, is in combination with carbonic acid, forming *carbonate of magnesia.* One hundred pounds of this carbonate consist of

Carbonic acid	51·7
Magnesia	48·3
	100·

or *one ton of pure dry carbonate of magnesia contains* $9\frac{2}{3}$ *cwts. of magnesia*—the calcined magnesia of the shops.

The proportion of this carbonate in the magnesian limestones varies very much. In some it forms nearly one-half of their weight, while in others it is almost entirely wanting. Even in the same quarry different beds are found to contain very different proportions, and are worked, therefore, for different purposes.

The quantity of magnesia which any such limestone contains determines in a great degree its value, either for building or for agricultural purposes. The larger the proportion of magnesia, the better it *binds* when used for mortar,—the smaller the proportion, the more safely in most districts of this country, and the more abundantly, can it be laid upon the land. Hence, most of the past analyses of these limestones have been made with the view of determining the relative proportions of lime and magnesia only. With this view chiefly were the following analyses made by myself, of magnesian limestones collected from different parts of the county of Durham:—

	Carbonate of Lime.	Carbonate of Magnesia.	Alumina, Oxide of Iron, and Phosphoric Acid.	Insoluble earthy matter.	Appearance of the specimen.
Garmondsway . .	97·5	2·5	trace.	trace.	Hard, compact, gray.
Stony-gate . . .	98·0	1·61	0·27	0·12	Crystalline, fine grained, yellow.
Fulwell	95·0	2·1	0·3	2·6	Honey-combed, crystalline, yellow.
Seaham (A) . . .	96·5	2·3	0·2	1·0	Hard, compact, fine grained.
—— (B) . . .	95·0	1·3	0·2	3·5	Hard, porous, brown.
Hartlepool . . .	54·5	44·93	0·33	0·24	Oolitic, yellow.
Humbledon Hill (A)	57·9	41·8	?	0·28	Perfect encrinal columns.
—— (B)	60·41	38·78	?	0·81	Consisting in part of encrinal columns.
Ferryhill	54·1	44·72	1·58	4·6	Compact, yellowish.

The second column of the above table shows, as I have already stated, that the proportion of magnesia varies very much, and consequently that the agricultural value of this lime from different localities must vary also. The specimens analysed are all remarkably free from earthy matter, but it is to be regretted that the exact proportion of phosphoric acid, or of phosphate of lime, was not separately determined.

The simplest method of detecting magnesia in a limestone is to dissolve it in diluted muriatic acid, and then to pour clear lime water into the filtered solution. If a light white powder fall, it is magnesia. The relative proportions of magnesia in several limestones may be estimated pretty nearly by dissolving an equal weight of each, pouring the filtered solutions into separate bottles which can be corked, and then filling them all up with clear lime water. On subsiding, the relative bulks of the precipitates in the bottles will indicate approximately the richness of the several varieties in magnesia.

SECTION II.—*Of the burning and slaking of Lime and Magnesia.*

1°. *Burning.*—When the carbonates of lime or magnesia contained in common limestone are heated to a high temperature in the open air, the carbonic acid they contain is driven off by the heat, and the lime and magnesia remain behind in the caustic state. When heated in this way, the carbonate of magnesia parts with its carbonic acid more easily and at a lower temperature than the carbonate of lime.

Both also are decomposed more readily when a *current* of air is allowed to pass through the burning mass. Hence on the large scale this burning is performed in kilns especially built for the purpose. In lime-kilns with an opening below to admit the air, the limestone is burned much more effectually, and at a much less cost of fuel, than in those round *pies* which in limestone districts the farmer often builds up for the use of his own farm. The reason of this is, that the current of air carries with it a quantity of watery vapour, which greatly promotes the separation of the carbonic acid from the lime.

When thus deprived of its carbonic acid by heat, the lime is known by the several names of burned lime, quicklime, caustic lime, and lime-shells.

One ton of good limestone yields about 11 cwt. of lime-shells. The weight of the shells per bushel varies with the kind of limestone and with the way in which it is burned. In some districts (Alnwick) the bushel does not weigh more than 75 lbs.; in others it approaches to a cwt. This is a great difference, and shows how uncertain the quantity applied to the land may be when it is reckoned by the bushel. Lime should be both bought and laid on by weight.

2°. *Slaking.*—Burned lime has a strong tendency to drink in and combine with water. Hence, when taken from the kiln and exposed to the air, it absorbs moisture from the atmosphere, increases in weight, swells out, and gradually falls to powder. Or if water be thrown upon the shells, they drink it in, become hot, swell very much, and fall down in a short time to a bulky, more or less white, and almost impalpable powder. When the thirsty lime has thus fallen, it is said to be *slaked.* If more water be now added, it is not drunk in, but forms with the lime a paste or mortar.

There are three ways in which burned lime is slaked.

a. Spontaneous slaking.—When the shells are laid up in heaps in the air and are allowed to draw moisture from the atmosphere, they fall to powder of themselves. This method is preferred in many districts. The lime is laid up in heaps, covered with sods, and left sometimes for months, till it has completely fallen, or till the time is convenient for laying it upon the land. Thus it is often carted in winter, covered up in heaps, and applied to the land in summer when preparing for the green crop. The lime seldom becomes very hot when slaked in this way, unless a heavy shower of rain happen to fall, when the surface of the lime heaps sometimes becomes so hot as to char and even to set fire to the sods by which they are covered. When slaked spontaneously, rich limes increase in bulk three or three and a half times. Poorer limes—such as contain much earthy matter—may not do more than double their bulk.

b. Slaking by immersion.—In this mode of slaking, the lime is put into a basket or bucket, is dipped into water for a short time, and when taken out is left to fall in the air. This method is found to possess certain advantages for engineering purposes, but it is never adopted, I believe, by the practical farmer.

c. By pouring water upon it.—This is the ordinary method of slaking quickly and for building purposes. The heat given off during this mode of slaking is in rich limes often sufficient to kindle gunpowder. The heat, however, is less, and the slaking less rapid, the longer the lime has been out of the kiln. Rich limes slaked in this way increase in bulk from two to three and a half times.

If the water be thrown on so rapidly or in so large a quantity as to *chill* the lime or any part of it, the powder will be gritty, will contain many little lumps which will refuse to slake, and will therefore be less bulky and less minutely divided.

The first of these methods is the best for agricultural purposes—and for the following among other reasons:—

a. It causes the lime to fall to the finest powder. It may be received indeed as a general rule, that *that limestone or that mode of slaking is the best for agricultural purposes, which gives a slaked lime of the greatest bulk and in the most minute state of division.*

b. It is the least expensive, requires the least care and attention, and exposes the lime least to become chilled and gritty—but

c. When thus left to itself, the lime heaps should be covered over with sods—*first*, to prevent the surface from being chilled, or the whole converted into mortar by large or continued falls of rain—and *second*, to exclude the too free access of the air, which gradually brings back the lime to the state of carbonate, as will be explained in the following section,

SECTION III.—*Composition of slaked Lime and Magnesia.*

1°. *Slaked lime.*—When pure quicklime is thus slaked, it *combines* chemically with a large quantity of water—one ton of pure lime becoming 25 cwts. of slaked lime. This slaked lime is called by chemists *hydrate* of lime, and the pure hydrate contains in 100 lbs.

Lime	76 pounds.
Water	24 pounds.
	100

Lime, however, is rarely so pure or so skilfully and perfectly slaked, as to take up the whole of this theoretical quantity. It seldom increases in weight so much as one-third.

2°. *Slaked Magnesia.*—The caustic or calcined magnesia contained in lime-shells also slakes and falls to powder when water is poured upon it, and forms a *hydrate* of magnesia. It likewise

swells and becomes hot, but not in an equal degree with pure lime.

Pure hydrate of magnesia consists of

Magnesia	69·7
Water	30·3
	100·

It increases in weight, therefore, in slaking more than lime does—1 ton of caustic magnesia becoming nearly 29 cwts. of hydrate.

When limestones containing magnesia are burned and afterwards slaked, the fallen lime consists of a mixture of the above two hydrates in proportions which depend upon the chemical composition of the limestones.

An important difference between these two hydrates is, that the hydrate of magnesia will harden under water or in a wet soil in about eight days—forming a hydraulic cement. Hydrate of lime will not so harden, but a mixture of the two in the proportions in which they exist in the Hartlepool, Humbledon, and Ferryhill limestones will harden under water, and form a solid mass. In the minute state of division in which lime is applied to the soil, the particles, if it be a magnesian lime, will, in wet soils, or in the event of rainy weather ensuing immediately after its application, become granular and gritty, and cohere occasionally into lumps, on which the air will have little effect. This property is of considerable importance in connexion with the further *chemical* changes which slaked limes undergo when exposed to the air or when buried in the soil.

SECTION IV.—*Changes which slaked Lime and Magnesia undergo by prolonged exposure to the air.*

When the hydrates of lime or magnesia obtained by slaking are exposed to the open air, they gradually absorb carbonic acid from the atmosphere, and tend to return to the same state of carbonate in which they existed previous to burning. By mere exposure to the air, however, unless they are in a minute state of division, and *the air have ready access to all their parts*, they do not become wholly converted into carbonate until after the lapse of a very long period of time. In some thick walls 600 years old, the lime has been found to have absorbed only *one-fourth* of the carbonic acid necessary to convert the whole into carbonate; in others, built by the Romans 1800 years ago, the proportion absorbed has not exceeded *three-fourths* of the quantity contained in natural limestones. In damp situations the absorption of carbonic acid proceeds most slowly.

1°. *Change undergone by pure lime during spontaneous slaking.*—In consequence, however, of the strong tendency of caustic lime to absorb carbonic acid, a quantity of the hydrate of lime

first formed, when lime is left to slake spontaneously, becomes changed into carbonate during the slaking of the rest. But, when it has all completely fallen, the rapidity of the absorption ceases, and the fine slaked lime consists of—

		per cent.		cwt.
Carbonate of lime	. . .	57·4	or,	11½
Hydrate of lime .	lime, — 32·4; water, 10·2	42·6		8½
		100·		20

Thus a large portion of the lime—about one-half—is again converted into carbonate of lime during this mode of slaking.

When left to slake in *large* heaps, the lime in the interior of the heaps will not absorb so much carbonic acid, as is above stated, till after the lapse of a very considerable time. More caustic lime (hydrate) also will be present, if it be left to slake—as is often done for agricultural purposes—in shallow pits, covered with sods to defend it from the air and the rains.

After the lime has attained the state above described, and which is a chemical compound of carbonate with hydrate of lime, the further absorption of carbonic acid from the air proceeds more slowly, and is only completely effected after a comparatively long period of time.

2°. *When slaked in the ordinary way*, lime falls to powder without having absorbed any notable quantity of carbonic acid. Numerous small lumps also remain, which, though covered with a coating of hydrate, have not themselves absorbed any water. The absorption of carbonic acid by this slaked lime is at first very rapid—so that, where the full effect of caustic lime upon the soil is required, it ought to be ploughed in as early as possible; but the absorption gradually becomes more slow, a variable proportion of the compound of carbonate and hydrate above described is formed, and even when thinly scattered over a grass field, an entire year or more may pass over without producing the complete conversion of the whole into carbonate. To this state of carbonate, however, it does at length come when long exposed to the air or long mixed with the soil.

The following table exhibits *the chemical changes which a ton of limestone undergoes*, and the relative proportions in which the several compounds exist in it after it has been burned, slaked, and then exposed to the air or mixed with the soil:—

Composition.	Limestone.	After burning.	After slaking.	Spontaneously slaked.	Exposed to the air or in the soil.
	cwts.	*cwts.*	*cwts.*	*cwts.*	*cwts.*
Lime .	11¼	11¼	11¼	11¼	11¼
Carbonic acid	8¾	—	—	2¾	—
Water .	—	—	3½	1¾	8¾
Total weight	20	11¼	14¾	15¾	20

2°. *Calcined or burned magnesia*, whether in the pure state or when mixed with quicklime, as it is in the magnesian limes, absorbs carbonic acid more slowly than lime does—and by mere exposure to the air may perhaps never return to its original condition of carbonate of magnesia.

When allowed to slake spontaneously, three-fourths of it become ultimately changed into carbonate, and form a compound of hydrate and carbonate which is identical with the common uncalcined magnesia of the shops. This compound consists of—

Carbonate of magnesia	69·37
Hydrate of magnesia	16·03
Water	14·60
	100·

and it undergoes no further change by continued exposure to the air.

But if slaked by the direct application of water, magnesia, like lime, forms a hydrate only, without absorbing any sensible quantity of carbonic acid. The hydrate thus produced is met with in the form of mineral deposits on various parts of the earth's surface, and this mineral is not known to undergo any change, or to absorb carbonic acid though exposed for a great length of time to the air. When magnesian limes are slaked by water, therefore, the magnesia they contain may remain in whole or in part in the caustic state, (that of hydrate,) and may change very slowly even when exposed to the air. When left to spontaneous slaking, one-fourth of the magnesia, at least, will always remain in the caustic state, however long it may be exposed to the air. When mixed with a soil containing vegetable matter, it is brought more constantly in contact with carbonic and other acids, and thus more speedily loses its caustic state; but the prolonged presence of this caustic magnesia is one of the causes of the injurious action which magnesian limes exercise upon the land.

Should a lime be naturally of such a kind, or be so mixed with the ingredients of the soil as to form a hydraulic cement or an ordinary mortar, which will solidify when rains come upon it, or when the natural moisture of the soil reaches it—the absorption of carbonic acid, either by the lime or by the magnesia it contains, will in a great measure cease as soon as it becomes solid, and a large proportion of the lime will remain caustic for an indefinite period.

SECTION V. — *States of chemical combination in which, after burning, Lime may be applied to the land.*

There are, therefore, four distinct states of chemical combination in which lime, after being burned, may be artificially applied to the land.

1°. *Quicklime or lime-shells*, in which the lime as it comes from the kiln is uncombined either with water or with carbonic acid.

2°. *Slaked lime or hydrate of lime*, in which, by the direct application of water, it has been made to combine with about one-fourth of its weight of water.

In both these states the lime is caustic, and may be properly spoken of as caustic lime.

3°. *Spontaneously slaked lime*, in which one half of the lime is combined with water and the other half with carbonic acid. In this state it is only half caustic.

4°. *Carbonate of lime*—the state in which it occurs in nature, and into which burned lime, after long exposure to the air, is more or less perfectly converted. In this state lime possesses no caustic or alkaline properties, but is properly called *mild* lime.

5°. Bi-*carbonate of lime* may be adverted to as a fifth state of combination, in which nature often applies lime to the land. In this state it is combined with a double proportion of carbonic acid, and is readily soluble in water. Hence springs are often impregnated with it, and the waters that gush from fissures in the limestone rocks spread it through the soil in their neighbourhood, and sweeten the land. In the soil, a portion of the lime that has been artificially added is gradually converted into bi-carbonate, from its contact with decaying vegetable matter, and thus is either more generally diffused through the soil or is washed out of it altogether by the frequent rains.

I shall hereafter speak of these several states under the names of *quick*-lime, *hydrate* of lime, *spontaneously slaked* lime, *carbonate* of lime, and *bi-carbonate* of lime. By adhering to these strictly correct names, we shall avoid some of that confusion into which those who have hitherto treated of the use of lime as a manure have unavoidably fallen. The term *mild* applies only to that which is entirely in the state of *carbonate*.

Magnesia, in the magnesian limes, may in like manner be either in the state of *calcined* magnesia, of *hydrate* of magnesia, of *spontaneously slaked* — meaning by this the compound of hydrate with carbonate—of *carbonate*, or of *bi-carbonate* of magnesia, the latter of which is soluble in water to a very considerable extent.

SECTION VI. — *Of the benefit of burning and slaking.*

But if lime, as above represented, becomes again changed into carbonate after it has been laid upon the land — nay, in part even during the process of slaking—what benefit does the farmer derive from the expensive process of burning and subsequent slaking? The benefits are partly chemical and partly mechanical.

1°. While in the caustic state, it acts more quickly in producing those chemical changes which follow from mixing it with the soil. Even in the half-caustic state of spontaneously slaked lime, its effects

are more rapid and more quickly seen, than when it is entirely in the state of carbonate.

2°. But the principal benefits arise from the minute state of division into which the lime is brought by burning and slaking. When the burned limestone is slaked, the lime falls to a powder—finer, probably, than any which could be produced by mere mechanical means—finer, certainly, than any to which the farmer could bring it, by any crushing machine he could afford to employ. This state of fine powder enables it

a. To be diffused more equably and more universally through the soil, and thus to go much farther in improving it.

b. To combine with acid substances in the soil, and therefore to sweeten it, more readily and more quickly.

c. To come into closer contact with the organic substances in the soil, and thus to promote more fully those chemical changes which are constantly going on in every fertile soil, and to promote which is one of the useful purposes for which lime is added to the land.

It is because of their minuter state of division that fine and dry marls are the most esteemed. The state of fine powder in which it is found, is one reason also why the infusorial sand of the Norman coast, already described, is found by the local farmers to be so much better for their land, and therefore more valuable than the shell-sand, which also abounds on their coasts.

SECTION VII.—*Of Lime composts, Lime and Salt, and the refuse Lime of the Gas-works.*

1°. *Lime composts.*—Quicklime is often mixed with the roots of weeds, with the cleanings of ditches, with peat, and with the parings of the hedge-sides, and is then laid up in heaps in the form of composts. When mixed in this way the decaying vegetable matter supplies a sufficient quantity of carbonic acid to convert the whole of the lime into carbonate. If these composts are exposed to the air for a considerable time, and especially if they are turned over once or twice, a small quantity of *nitrate* of lime is produced, a compound which is very favourable to the growth of plants. In composts, therefore, the lime exists chiefly in the state of carbonate, a small and variable proportion being in the state of nitrate, and perhaps of sulphate, and humate. The last of these, the humate, is a compound of lime hereafter to be described.

2°. *Lime and salt.*—When common salt and slaked lime are mixed together, the salt is decomposed in whole or in part, and the soda of the salt is brought into the caustic state, while the lime is converted into chloride of calcium.* Both of these are very soluble

* *Calcium* is a peculiar white metal, which, when heated in the air, takes fire and burns, combining with the oxygen of the air, and forming *lime*. Lime, therefore, consists of calcium and oxygen.

Sodium is a white metal, which also takes fire and burns when heated in the air,

in water, and can therefore readily act both upon the soil and upon the plant. Wherever common salt is useful to the soil, this mode of applying it in connexion with the lime may be safely recommended. It should be mixed with the lime in such quantity as to allow from 1 to 4 cwts. of salt to be laid upon each imperial acre. The salt may be dissolved in water, and thrown upon the lime, where it is the custom to slake it with water, or sea-water may be employed, without admixture, for slaking the lime.

The Liverpool refuse salt, when well mixed with quicklime, is said to form a powerful dressing for wheat and to benefit the after clover and oats.

3°. *Refuse lime of the gas-works.*—This refuse lime consists of a mixture of carbonate of lime with a variable quantity of gypsum and other salts of lime containing sulphur, and a little coal-tar and free sulphur, the whole coloured usually by a little Prussian blue. The following table exhibits the composition of two gas-limes which have been analysed in my laboratory, the one from the Edinburgh gas-works, and the other from the gas-works in Brick Lane, London. The first two columns show what they *were* when sent to me, the second two what they *will become* after long exposure to the air, after being made into compost, or after being thoroughly and for a length of time incorporated with the soil:—

COMPOSITION OF GAS-LIMES.

	As they are.		As they will become.	
	Edinburgh.	London.	Edinburgh.	London.
Water and coal-tar	12·91	9·59	12·91	9·59
Carbonate of lime	69·04	58·88	67·39	56·41
Hydrate of lime (caustic)	2·49	5·92	——	——
Sulphate of lime (gypsum)	7·33	2·77	16·45	29·32
Sulphite and hyposulphite of lime*	2·28	14·89	——	——
Sulphuret of calcium	0·20	0·36	——	——
Sulphur	1·10	0·92	——	——
Prussian blue	2·70	1·80	2·70	1·80
Alumina and oxide of iron	——	3·40	——	3·40
Insoluble matter (sand, &c.)	0·64	1·29	0·64	1·29
	98·69	99·82	100·09	101·81

combining with its oxygen, and forming *soda*. Thus soda consists of sodium and oxygen.

Chlorine is a peculiar kind of air, of a greenish yellow colour, which exists in common salt, and forms three-fifths of its weight.

Common salt is a combination of chlorine with sodium, and is called *chloride of* sodium.

When lime and common salt are mixed, the lime gives up its oxygen to the sodium, and the common salt its chlorine to the calcium, forming soda and chloride of calcium. The change will perhaps be more intelligible to the reader when represented thus:—

$$\left.\begin{array}{r}\text{Chloride of Sodium, or}\\ \text{Common Salt}\end{array}\right\} = \left\{\begin{array}{l}\text{Chlorine . .}\\ \text{Sodium}\end{array}\right.$$
$$\text{Lime . . . .} = \left\{\begin{array}{l}\text{Oxygen}\\ \text{Calcium . .}\end{array}\right.$$
$$\left.\begin{array}{l}\text{Sodium}\\ \text{Oxygen}\end{array}\right\}\text{Soda}\qquad \left.\begin{array}{l}\text{Chlorine}\\ \text{Calcium}\end{array}\right\}\text{Chloride of Calcium.}$$

* This includes a small quantity of cyanide and sulphocyanide of calcium, which are soluble in water, and are present, as all these compounds of sulphur are, in variable quantity.

This table shows that these gas-limes differ much in composition, especially in the proportions of sulphur or of the acids of sulphur they contain. This arises chiefly from the kind of coal which is employed in the manufacture of gas in different works. In Scotland, different varieties of cannel coal are very extensively employed; in London, the better kinds of Newcastle coal are chiefly used, all of which either contain or give off more sulphur than the best cannel coals of Scotland.

The most marked difference between the two samples here analysed, is in the compounds called *sulphite* and *hyposulphite* of lime. The latter of these substances dissolves readily in water, and its presence in such very different proportions satisfactorily accounts for the very different effects which have followed from the application of gas-lime to the land in different districts. The rains dissolve the hyposulphite and the sulphuret, and carry them down in too great quantity to the roots of the young corn; and hence the complaints of some, that the gas-lime has killed their wheat, while others have found, when applied as a top-dressing in a similar way, that it greatly improved their crops of corn. Unless its composition be satisfactorily ascertained, therefore — unless, for example, it be found that water dissolves very little of it—there will always be a degree of risk in applying it directly to the land while any corn crop is growing. There may not be the same danger in putting it between the turnip or potato drills, and afterwards ridging up the land in the way in which quicklime is applied in many districts. To fallow land, however, to land which it is intended to reclaim, and especially to mossy land, the Scotch varieties at least may be applied directly, with safety, and with great benefit. In the neighbourhood of Paisley it is in constant demand for the improved moss lands, and sells at about 1s. 6d. a cart-load.

But those varieties which contain the largest quantity of the soluble hyposulphite of lime also form at last the largest quantity of gypsum. Thus the Edinburgh lime analysed would never come to contain more than 17 per cent, but the London lime might eventually contain as much as 30 per cent of gypsum. This suggests the propriety, therefore, of laying it on and harrowing it slightly in some months before any crop is sown — in the spring, for instance, before the turnip sowing—or of making it into composts, perhaps the best and safest method of all.

This lime ought in no case, if possible, to be wasted, and from what has been above stated, it appears that it may always be safely used —

a. Directly upon mossy land, upon naked fallows, and in spring when preparing for the turnips.

b. In composts, in which, by the action of the air, the whole of the soluble salts of lime will have a tendency to be converted into

gypsum, and consequently the benefits which result from a large application of gypsum will be obtained by laying such composts upon the land.

c. As it appears usually to contain only a small proportion of caustic lime, it may be with safety mixed at once with the manure, though not in too large quantity. It may also prove a valuable admixture with guano, on which its action will ultimately be to fix rather than to expel the ammonia.

d. Strewed *sparingly* over the young braird, it is said to prevent the attacks of the turnip fly, and harrowed in, in considerable quantity, when the ground is naked, slugs and *wire-worm* disappear before it. The action upon this last pest of the farmer will probably be greatest when the soluble hyposulphite is largest in quantity. If as dry as the specimens of which I have given the analysis above, the gas-lime is worth to the farmer, at least, one-half as much as an equal weight of quicklime.

If applied in too large quantity in this way, however, it is sometimes injurious to the young corn crop, which has not time to recover from its effects till much of the season of early growth is past. But grass land, though at first browned by the application, soon recovers and repays the cost of application by yielding a greener and earlier bite in spring.

It is at present proposed to mix a quantity of sulphate of soda with the lime in the dry purifiers of the gas-works; should this method be introduced the refuse lime will become of much more value than heretofore as an application to the land.

THE HISTORY, NATURE, PATHOLOGY, AND TREATMENT OF THE EPIDEMIC PLEURO-PNEUMONIA.

By JAMES MERCER, M.D., F.R.C.S.E. Edinburgh.

WHEN we consider the vast number of cattle that are annually required for the consumption of the United Kingdom, averaging generally 1,600,000, exclusive of calves and the dead market, we cannot but be struck with the absolute necessity of attending to every circumstance relating to the breeding, management, rearing, and feeding of cattle, so as to enable the country to produce, within itself and without foreign aid, a supply equal to so large a demand. To the great losses necessarily entailed on breeders and graziers generally by the occurrences of accidents which are apt to befall their cattle, there is another and very important source, that of the occasional prevalence of epidemic disease.

It is well known that veterinary schools owed their origin chiefly to the ravages of epidemic disease among cattle, and that "they were established for the express purpose of teaching a more systematic knowledge of the management of sheep and cows." This

noble attempt, however, has been comparatively frustrated by an almost total neglect of the special object for which these colleges were originally instituted, by neglecting even to mention the subject of cattle diseases in their prelections, and devoting the whole of their attention to the horse.*

It is also well known that, even at present, there are two great sources of the mortality of sheep and cattle, and the loss of much agricultural property; and it is difficult to say which is the worst, the ignorance and obstinacy of the servant and the cow-leech, or the ignorance and supineness of the owner. To these may be added another source of mortality, and that perhaps the most important of all—the mystery which clouds the minds of cattle-men and cow-leeches generally in reference to the real history and causes of epidemic zootic diseases. By the generally adopted opinion, that the primary exciting cause of such ravaging epidemics is dependent on the existence of some hidden and mysterious agency over which they can have no control, their minds become paralysed, and no efforts are made to attempt any method of treatment, leaving their valuable stock to proceed to fatal destruction, as if they were spell-bound by some enchantment. But a little more intelligence, and a faithful dependence on the symptoms of the disease exhibited, that they are not the result of any "mysterious agency," but the results of "natural causes" that are equally within the power of active and early treatment as that of the simple and perfectly understood form of diseases generally, would inevitably dispel such delusion.

It is well known that epidemic zootic diseases have, more or less, frequently ravaged many countries from the earliest period of history. During the past century they have made havoc in all the kingdoms of Europe; and none have been so direful in the extent of their ravages as that formerly denominated epidemic catarrh, murrain, and at present pleuro-pneumonia. From the earliest accounts of this disease, we find that the predisposing cause of it was generally attributed to marshy and woody districts, or where perfect under-draining did not exist, combined with exposure to sudden change of the atmosphere, and a half-starved method of feeding. The influence of the above-named predisposing causes are allowed their full support by the agriculturists of the present day; but to these must be added others, and perhaps more important ones—viz. the crowded state of our dairies and cattle-houses, and the quantity of filth that is carelessly left for a considerable time before it is removed; add to these the universal want of ventilation and complete drainage, by the absence of which putrefactive fermentation is rapidly produced, and the organic gases and compounds saturate the atmosphere, which animals are compelled to inhale for

* Youatt *On Cattle*, p. 2.

weeks and months together. No wonder, then, if disease of the simplest kind be instituted, that its ravages must be great, arising entirely from the vitiated constitution on which it acts at its first onset. It is more a wonder that it is so small. It has been already stated that a "deep and hidden mystery" has hitherto, and even at the present time, been supposed to envelop the *exciting* cause of the disease; or, in other words, that it is consequent on some poison or other *specific miasm* existing in the air, and which *miasm* produces a *specific effect* on the animal structure, over which the whole ingredients of the pharmacopeia or the skill of the hippiatrist has no control; and consequently, in the opinion of the owner, if the disease has become fully developed, so as to render the animal unmarketable, it is usually left to its fate. It is very unfortunate that this opinion is so generally believed and acted upon, both by the owners and the veterinarian; and I have no hesitation in stating that it has been so long and so rigidly acted upon, that myriads of cattle have been allowed passively to go to destruction. Unless, therefore, a change of opinion, as proved by an enlightened intelligence and an approved experience, takes place, it cannot but happen that a continuation of this opprobrium of science must inevitably remain. Let the cattle-man be made confident that the exciting cause of the disease is not specific in its nature, but is the result of a simple cause, to which all the structures of the animal frame are exposed, and which can produce in them all those diseases to which mortal "flesh is heir to;" that the majority of such diseases are well known to be under the direct control of remedies promptly and efficiently applied; and that they can thereby be made perfectly recoverable; then it will follow, that, if the cattle-man be intelligent enough to detect the immediate onset of this hitherto frightful scourge, the success of its treatment will be such as to remove it from its present dreadful condition, and place it in the category of our simple forms of disease; that if the cattle-owner and the veterinarian still cling to their former notions as to the specific and infectious nature of the disease, no attempts, however made, will remove the incubus from their understanding, and the scourge will still be permitted to cause its direful ravages.

Before proceeding to the consideration of the symptoms, pathological appearances, and treatment of the present epidemic, pleuro-pneumonia, I shall premise with a short description of the healthy tissues of the lung, the special organ affected, in order that the symptoms shown by the disease and the post-mortem appearances may be more easily understood.

The structures that enter into the formation of the lung comprise two distinct sets of vessels—those carrying on the *function* of the lung, and those for its *nutrition*. To the first of these I shall only direct attention, as it is essentially in them that the morbid ravages of the epidemic are formed.

The functional vessels of the lung are three in number. The *aërial* vessels for conveying the surrounding atmosphere into the ultimate ramifications of the air-cells. This great vessel, the windpipe, may be likened to a tree, the stem of which is the trachea, the larger branches the bronchi, and the leaves the air-cells. These air-cells form the greater part of the structure of the lung; around their grape-like extremities, the capillary plexus of the pulmonic vascular systems ramify most abundantly; and their interior surface is lined with a fine and extremely sensitive mucous membrane, derived from the great gastro-pulmonary membrane. The functions of these air-cells are to contain a large quantity of air, which, surrounding the capillary vessels filled with *impure venous blood*, these latter vessels are, as it were, bathed by the aërial fluid, and by its means the *impure venous blood* is changed in its properties and converted into *pure arterial blood.* The second set are the pulmonic venous system, whose function is to carry the impure venous blood from the right side of the heart to the air-cells. There the carbonic acid which is contained in the venous blood of the body generally, is secreted from it by the air-cells, and expelled from the system by the process of expiration. Another change at the same time takes place—the absorption of the oxygen of the atmospheric air in the air-cells, on which the blood, becoming oxygenated, is converted into pure arterial blood.

This pure blood is conveyed by the third set of vessels to the left side of the heart, thence to be circulated in every part of the body for the nourishment thereof, and to be again returned as impure venous blood. The whole of these systems of vessels are bound together by interlacing filaments of cellular tissue, which bind them together to form the lung. Thus formed, the entire lung is invested by a general membrane of a serous nature—the pleura; and which, being reflected over the interior of the walls of the chest, enables the lung to play freely therein in the processes of inspiration and expiration.

These structures, with the nutrient vessels, form the tissues of the healthy lung; and the pathological effects which take place in them are thereby arranged under three forms.

1*st*, Inflammation of the mucous lining of the bronchial tubes and air-cells—bronchitis.

2*dly*, Inflammation of the pulmonic vascular substance, or the parenchyma of the lung—pneumonia.

3*dly*, Inflammation of the investing serous membrane of the lung—pleurisy, or inflammation of the chest.

Bronchitis.—This form of inflammation is the first of the series of the pulmonic tissues that are affected and induced by the direct application of those simple causes that produce inflammation in the other structures of the body. The symptoms indicating its onset are always very insidious, the disease seldom developing itself until subsequent ravages have been produced. When the disease is

present, the animal becomes dull and languid, with great depression and apparent debility; the cud becomes lost; the coat staring; coldness in the extremities comes on; the roots of the horns, the ears, and the inside of the mouth become cold; there is dulness of the eye; increased breathing; cough—at first short and soft, then loud, harsh, rough, and prolonged; slight discharge from the nostrils; a watery eye; and the pulse more frequent, but full and soft. All the secretions are checked.

Pneumonia.—If these symptoms are neglected, and no treatment be adopted in this, the only stage of the disease in which immediate benefit can be obtained, the substance of the lung becomes rapidly engaged, and thereby developing more fully the general febrile symptoms. The ravages in the pulmonary substance rapidly extend, until an entire lobe, or even the whole lung, may be involved. The essential symptoms of pneumonia then become developed, and all the symptoms appear more complicated. The breathing becomes weaker, slower, and stifled, as if some weight pressed on the lung, impeding its free and full expansion; the cough is short and stifled, often accompanied by a prolonged grunt; the animal looks wistfully to the affected side, as if instinctively pointing out the site of the disease; the flanks are heaved and tucked up, so as to aid respiration; the pulse becomes very small, oppressed, and weak, as if the vessel that was felt had not its full contents, indicating that the heart propelled it with difficulty, and was itself oppressed and overloaded from the excessive congestion of the pulmonary tissues; all the general symptoms become more aggravated and complicated, and the disease proceeds rapidly to its fatal termination.

Pleurisy.—If the disease extends to the pleura, the symptoms again become much changed, indicating pleurisy. The pulse becomes more rapid, small, hard, and wiry; the breathing stops short and is only partially finished, and is immediately followed by a short, catching cough; the head is also turned to the affected side, and if the clenched fist be forcibly thrust against the side of the chest, the animal immediately evinces severe pain, and a sudden short cough is instinctively produced. The general symptoms are now developed to their greatest severity; but the ravages now extending to every tissue of the lung, the disease proceeds with the greatest rapidity to its fatal issue. The characteristic symptoms of these three forms of disease may be thus arranged:—

In Brochitis. — Breathing is quick and free.
Cough, at first short and soft, then loud, harsh, rough, and prolonged.
Pulse, frequent, but full and soft.

In Pneumonia.—Breathing, weaker, slower, stifled.
Cough, short and stifled.
Pulse, small, weak, and oppressed.

In Pleurisy.—Breathing, short and only partial.
Cough, short and catching.
Pulse, rapid, hard, and wiry.

The post-mortem appearances, in almost all my cases of dissection, varied much in their extent of destruction of the pulmonary tissues, according to the stages of the disease which had proved fatal. Where the bronchitis alone, or only complicated with simple pneumonia, proved fatal, the investing membrane of the tongue generally presented considerable evidence of disease of the cutaneous covering along its surface. It was raised up in the form of detached scales, and very rough over its entire surface; along its sides, vesicles and ulcerated spots were frequently found, similar to those accompanying gloss-anthrox or blain. The tongues of many of the carcases brought to the market were in this state of disease, but they were immediately put out of sight and removed by the sellers. The lining membrane of the gullet, the stomach, and the intestines were inflamed in patches, and here and there patches of ulceration were found. The lining membrane of the trachea, bronchi, and the large air-cells that could be easily traced, were highly inflamed; the tubes were filled with frothy, purulent, and bloody matter; and where pneumonia had been present, the morbid appearances of that form of disease were also found. These consisted of pulmonary vascular congestion around the air-cells, giving rise to bloody congestion of the parenchyma. If an incision was made into it in this stage of the disease, the blood poured out from the cut surfaces of the incision. If the disease had been further advanced, the effusion of a new morbid matter was found in the substance of the lung, causing hypatrophy or hepatisation of it, and consequent obliteration of the air-cells. Sometimes purulent matter was found diffused through the lung, at other times collected into abscesses or vomicæ, that often communicated with the bronchial tubes or the cavity of the pleura. When pleurisy also occurs, the effusion of plastic lymph and puriform matter becomes rapidly formed, and fills up the cavity of the chest. The surface of the lung was also coated with this lymph, and frequently recent adhesions were found between its free surface and the sides of the chest. The cavities of the heart, in cases of complicated pleuro-pneumonia, were always found congested with grumous blood; and the vessels of the brain were in a similar state.

Treatment.—The old adage, "Prevention is better than cure," could not be more efficiently illustrated in its fullest extent than in relation to pleuro-pneumonia, or any other epidemic or sporadic forms of diseases, to which our frail humanity is so liable; and from our daily experience at present, when inflammatory diseases and dangerous fevers are ravaging unlimitedly amongst us, we invariably find that where no means of prevention, or but partly so, had been adopted, the cure of these diseases became impossible, and

the mortality of the scourge has been really frightful. What is therefore true in the treatment of human, must be also true in animal disease. The difference between such, in every point of view, is but trifling, though many think otherwise who have but a superficial degree of knowledge of the structures of man and of the brute creation, and who are thereby incompetent to form any opinion.

Drink deep, or taste not the Pierian spring.

The improvements which the Poor Law Commissioners recommended to the Legislature, on the sanatory condition of the labouring population of Great Britain, would prove equally beneficial, if the adoption of them were rendered compulsory in respect to the labouring cattle of the country. The great benefits that have been obtained by the labouring poor by the improvement in the sanatory condition of their dwellings, is a matter of surprise to all; and would such not unquestionably follow, if the same means were used to improve the byres of our dairies, and the sheds of our cattle-yards?

In referring especially to the treatment of pleuro-pneumonia, every precautionary means for its prevention should be had recourse to; such as efficient ventilation, a comfortable atmosphere, perfect drainage, cleanliness, and good feeding. Without these, the disease will always be found predominant. When the disease does occur in any cow-house, characterised by the symptoms I have enumerated, immediate and decided treatment must be had recourse to. Bleeding should at once be adopted; and this, to be beneficial, must be carried to such an extent as will make a decided impression on the circulation, so as to check the further progress of the disease. If this be effected, and the symptoms become moderated, the bleeding must *not* be again employed, as irremediable debility would rapidly follow. Promiscuous bleeding, "right and left," is to be by all means avoided; for without a careful analysis of the symptoms and of the stage of the disease that is present, the rapid fatality of it after the bleeding will at once show its great impropriety. After the bleeding, a full saline purge should be exhibited.

One pound of Epsom salts, one drachm of tartar emetic, and two or three drachms of ginger, mixed in water, should be given, and repeated until free purgation has been produced. When this has been accomplished, then let there be regularly exhibited, at stated intervals, an anodyne diaphoretic mixture, consisting of half an ounce of laudanum, two drachms of tartar emetic, and two pints of water. This ought to be repeated every four or five hours, according to the state of the symptoms, so as to keep up the diaphoretic effect. The animal should be carefully removed from its companions, and placed in a well ventilated and comfortable loose-box, and free from sudden atmospheric changes. Let it be covered with a warm woollen rug, to prevent the too rapid evaporation of the sweat, so as chill the animal. Warm bran mashes, and tepid meal and water, should be left beside it, and a little of any slightly stimulating food

that may be at hand. Should symptoms of debility remain, then tonics are required, beginning the stimulation very cautiously at first. The common bitter tonic, chamomile tea, is perhaps the best and safest at first, but as the strength increases, stronger medicines must be used. Infusions of gentian, columba, cascarilla, &c., are those chiefly employed.

I shall now conclude with a few impressive remarks, deduced from the foregoing statements, in reference to the secret of safely and successfully attempting to cure this hitherto frightful malady. The responsibility rests on three individuals: the owner of the cattle; the servant or cattle-man, and the veterinarian. If the owner will but improve the sanatory condition of the dwellings of his property, he will do much to prevent the occurrence of the disease. If the cattle-man be intelligent, and by the slightest change in the condition of the animal he detects the first onset of the disease, he fulfils half the cure. And if the veterinarian be confident and decided in his treatment, and his mind is not blinded by the fancies of infection, the treatment proposed will be found frequently successful, and this wicked scourge will soon be made to take its flight, and become no more the dread of the honest and industrious agriculturist.

Since the foregoing remarks were written, I have been fortunate enough in obtaining a perusal of the first Report of the Metropolitan Sanatory Commissioners of London.* I am induced, thereby, to add a few further remarks as to the absolute importance of "preventing the occurrence of the disease," by the adoption of the proper means for improving the sanatory condition of our dairies and cattle-sheds.

"Nothing can be more clear and convincing than the facts and evidence brought forward in this report, to show the close connection between dirt and disease, the intimate alliance between foul drains and fever.

"There is a singular apathy on the part of the general public as to sanatory reform—an apathy, out of which existing fever and threatened cholera can scarcely shake them. It is a matter of universal experience, that the most powerful enemy of sanatory improvement is to be found in paltry local impediments, in the shape of private interests and vested rights. These, however, ought not to stand in the way if any thing is to be done, and for overcoming them, the friend of sanatory reform must be prepared."

It is an old proverb, and a good one, that "What is every body's business, is nobody's business,"—and this is too truly the case in reference to sanatory reform, whether applied to the inhabitants of cities, towns, or villages, and is also equally applicable to our present subject, the sanatory improvement of the agricultu-

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* See also an admirable paper on "Sanatory Reform in Edinburgh," in the *Scotsman* of December 8th, 1847.

ral stock of the country. The commissioners appointed by government to draw up the above-named report, seem to have been fully alive to this trite saying. If they had recommended the constitution of a sanatory board on a footing similar to those at present existing, which consist of a number of distinct boards from different districts, each having its own rights and interests, it would have been again found impossible to prevent another clashing of interests, which must have inevitably ended as before, in nothing being done to forward the special objects of their appointment. Instead of this, or a number of independent and unco-operative boards, they have recomended *one central board* of twenty-three commissioners, and consisting of persons best known for the interest which they have long taken in sanatory reform, as well as for the scientific acquirements which they possess of the theory and practice of the remedies which it would be necessary to employ. The importance of this step might be sufficiently inferred from the simple fact, that these twenty-three commissioners will possess the authority that was formerly invested in the sum-total of six hundred individuals.

"Thorough draining is the root and essence of sanatory reform; without it, the best exertions for cleanliness, and the most arduous endeavours for the preservation of health, lose all their force and value."

The produce of agricultural property may be considered as essentially consisting of two distinct kinds, which I shall denominate, for illustration—first, the cereal or grain crops; and secondly, the grazing and fodder crops, or the cattle crops,—and, connected with the latter, the comparative value of the cattle stock.

It would be considered a useless and unnecessary repetition, were I to say one sentence in reference to the wonderful success which has universally been found to follow well-directed efforts to increase the fertility of the soil by the adoption of thorough draining. This is well known to every person possessing even a superficial knowledge of the science of agriculture. I shall therefore conclude with one quotation—

> In grounds, by art laid dry, the aqueous bane,
> That marr'd the wholesome herbs, is turn'd to use;
> And drains, while drawing noxious moisture off,
> Serve also to diffuse a due supply.

It cannot but be evident to one who takes a true view of the comparative importance of the value of the cereal crops and that of the cattle stock, that, at first sight, the former appears to be the more important of the two. Such, indeed, is the general feeling amongst farmers, throughout the United Kingdom. It is that part of their agricultural property, on the produce of which they chiefly depend for the payment of their rents. And, further, from the improvements which have followed draining, and a more perfect system of agriculture, the farmer looks upon his grain crop as his standard

one. The confidence which he reposes in it is such, that after tilling the ground in a skilful manner, he implicitly trusts to have at least a general average of crop produced, both in quantity and quality; and in this he is seldom disappointed. But it is very different with the cattle stock. It is property of the most precarious tenure, and, therefore, it should be most highly valued by the farmer. But has this ever been the case, or is it so at the present time? I fear not.

From what I have stated in the former part of this paper, and from what I have here appended, I have adduced sufficiently important reasons to show that a greater value ought to be attached to the more efficient management and feeding of the cattle stock, than has hitherto been done; and if the same skilful endeavours that have been adopted to improve the soil and to produce an increase of crop, would be employed in effectually improving the sanatory condition of the cattle stock, infinitely less ravages by disease, and less loss generally, would result to the farmer. By adopting the well-known means for preventing the origin of disease from dirt, damp, bad ventilation, and worse feeding, I have no doubt that the casualties which have hitherto attended the cattle stock will be as far removed, and the results will be as prominently successful, as those which have followed the improvement of the soil.

Then it will be that the farmer will see reason to value his cattle stock more highly than at present, and that he will as confidently look forward to an average produce on this stock, as he may, at present, look on the grain crop.

It may very naturally be asked by the tenant-farmer, whether or not it must be he or his landlord on whom the duty devolves of being at the expense of improving the sanatory condition of the farm tenements. This is easily answered—the nature of the tenure of the lease. In the greater part of Scotland, leases usually extend to 19 or more years: and were all tenant-farmers to possess leases of this duration, I feel assured that an intelligent man, assured of the benefits that would infallibly accrue to him by the greater security of his cattle stock, and consequently by a greater produce therefrom, he never would grudge the expense of the outlay of money in effecting a complete change in the sanatory condition of his onstead. It must happen thereby, that as great an increase in the value of this agricultural property will take place during his lease, as would have accrued to him had he confined himself entirely to the improving of the fertility of the soil. Whoever of the two, having a vested interest in the property, may undertake the improvements mentioned, let there be only one dictator appointed, with full powers to carry out, in all particulars, the necessary improvements, and the profits resulting therefrom will be equally available to the landlord as to the tenant.

THE FARMERS' NOTE-BOOK.—No. XIX.

On Useful Insects and their Products.—By JAMES H. FENNELL, Author of "A Natural History of Quadrupeds," &c.—Though insects probably far exceed in the number of species every other class of animals, yet comparatively few species of this class are turned to any useful account in the arts, manufactures, and domestic economy. We must not, however, conclude from this circumstance, that the thousands of species that are never used by man are therefore destitute of any properties that might be advantageous to him. When the manufacturing portion of the people shall have acquired a more extensive knowledge of the various properties and secretions of insects which entomologists have already noticed and recorded, then, perhaps, a greater number of species will be recognised as useful. Linnæus observes that "The man who shall take delight in studying insects, may have his labour rewarded by the discovery of a more grateful sweet than honey, a stronger thread than that of common silk, a more glowing crimson than that of cochineal; but he will require patience, perseverance, and repeated observation."* Admitting that the number of species that are rendered useful is comparatively small, yet I doubt not that I shall be able to show that it exceeds what most persons would suppose.

To render the subject more clear and intelligible, and also for the sake of convenience, I shall arrange my examples according to the classification of the species to be cited, and not according to the nature of their services.

I. *Coleoptera.*—In this order, consisting entirely of beetles, are many that contribute to the necessities and some to the vanities of man. The larvæ, or grubs, of various species are eaten in different parts of the world; and those who eat them assure us that they equal in excellence the best dishes that are enumerated in our cookery books. The grubs of all the African beetles that feed upon decayed wood, Smeathman affirms to be rich and delicate eating; and every traveller might, therefore, get plenty of this wholesome nourishment, did he but know where to seek it. In the cavity formed in the stem of the cabbage-palm, owing to the removal of its cabbage-like produce, the palm-weevil (*Calandra*, or, *Cordylia palmarum*) deposits her eggs, and the grubs which are hatched from these are eaten as great delicacies. These grubs are also found, in some places, devouring the terminal buds of cocoa-trees. Each of these grubs has a black head, and when fully grown is about as large as the thumb—that is to say, from two to three inches in length, and three-quarters of an inch in diameter.

* *Amœnitates Academicæ*, vol. ii. p. 356.

Ælian mentions an Indian king who set before his Grecian guests some roasted worms taken from a plant; but there can be no doubt that the historian alludes to the grubs of this beetle, for he adds, that the Indians esteemed them very delicious, and that so, likewise, did those Grecians who were prevailed on to taste them.* In both the East and the West Indies, these grubs are in great repute at the present day. Madame Merian, in her very faulty work on the insects of Surinam, tells us that the natives of that country roast these grubs, and then eat them with great enjoyment.† Stedman relates that a Negro brought him a feast of *gru-gru*, by which name these cabbage-palm grubs are known throughout the West Indies. "However disgusting they may be in appearance, these extremely fat grubs are," he declares, "a delicious treat to many people, and they are regularly sold at Paramaribo. The manner of dressing them is by frying them in a very little butter and salt, or by spitting them on wooden skewers. In taste, they savour of all the Indian spices, as mace, cinnamon, cloves, nutmegs, &c. Several species of these grubs are produced in all the palm-trees, when beginning to rot, but some are larger than others; they have all, however, pale yellow bodies, with black heads.‡" The Rev. Lansdown Guilding says the cabbage-palm grubs are eaten by a few persons in Surinam, that they are fried in butter, and that the greedy epicure, holding the hard horny head of the insect between his fingers, sucks out the fat entrails.§ Kirby and Spence were informed by a person who had long resided in the West Indies, that Sir John La Forey, who was somewhat of an epicure, was extremely fond of these grubs when properly cooked.‖ Mr H. Marshall, deputy-inspector of army-hospitals, says that in British Guiana, where these grubs are called *ducuma*, or *grugan*, they are reckoned a great delicacy by the gourmands and woodcutters, and are generally cooked in a frying-pan. Some, however, prefer them raw, and in that state they seize them by the black head, dip them in lime-juice, and then swallow them.¶ Another traveller states that the palm-tree grubs are esteemed such great delicacies in one part of the world, that they are monopolised by the royal family and mandarins of the first distinction. "A present," says he, "of about a dozen of these grubs was sent to us by the viceroy as a mark of great

* Ælian, *Hist.* lib. xiv. c. 13.

† Merian's *Insects of Surinam*, p. 48. Her figure of the gru-gru resembles nothing in nature but a lump of fat. For descriptions and coloured plates, fully illustrative of this insect and its transformations, see an article by the Rev. L. Guilding, in the *Transactions of the Society of Arts*, vol. xlvi; or an abstract of the same with woodcuts, in the *Magazine of Natural History*, vol. v. p. 466–469.

‡ Stedman's *Surinam*, vol. ii. p. 23.

§ *Magazine of Natural History*, vol. vii. (1834) p. 370.

‖ *Introduction to Entomology*, vol. i. p. 298.

¶ *Field Naturalist*, vol. i. (1833) p. 129.

respect. We did not eat them, but gave them privately to a woman, who was highly delighted with the delicacy that our fastidious taste rejected." The grubs of the longicorn beetles are often eaten by the natives of some of those countries in which they are found. This is particularly the case with the grubs of the *Macrodontia cervicornis*, a large and remarkable-looking species, known throughout Brazil and Cayenne by the name of *mouche scieur de long*. The Rev. F. W. Hope says that some of the native tribes of India in the vicinity of Travancore, and in the island of Ceylon, feed on the grubs of *Lamiadæ*, as is the case in Africa with *Lamia gigas*, now called *Omacantha*, by M. Serville.* In Surinam, in America, and in the West Indies, not only the black but the white inhabitants wash and roast the grubs of the *Cerambyx damicornis*, (each as thick as a man's finger,) and then eat them, and assert that they are delicious.† Mr Hall told Kirby and Spence, that this grub is called *macauco* in Jamaica, where it is in request at the first tables. A similar grub is dressed and eaten, under the name of *moutac*, both by whites and blacks at Mauritius.‡ According to Linnæus, the grubs of *Cerambyx cervicornis* are held in equal distinction. Those of *Lamia tribulus*, when roasted, are eaten in Africa.§ Kirby observes, that it is probable that all the grubs of the several species of *Cerambycidæ* might be safely eaten, as well as those of many other beetles; and although he does not feel disposed to recommend, with Reaumer, that the grubs of the rhinoceros-beetle (*Oryctes nasicornis*) should be sought for in the hotbeds or dungheaps,‖ yet he thinks with Dr Darwin,¶ that those of the cockchafer (*Melolontha ruficornis*,) which feed on the roots of grass, or the cockchafers themselves, are, (if we may judge from the eagerness of cats, dogs, turkeys, &c., in devouring them) no despicable *bonne bouche*, and might be added to our side-dishes. The adoption of this hint would soon have the good effect of lessening the numbers of these destructive insects. In 1688, immense numbers of cockchafers appeared in the county of Galway, in Ireland, where their grubs are called Connaught worms, and were eagerly devoured by swine and poultry, to which creatures they proved a nutritious and fattening food. This fact being observed by the people, they adopted a mode of dressing these insects, and then ate them themselves.** Pliny's *Cossus* (which he tells us lived commonly in the oak, and used to be fattened with flour by the Roman epicures) was, most probably, the grub of a beetle of the family *Cerambycidæ*.†† If it was not of

* *Mag. Nat. Hist.* vol. ii. (new series) p. 232.
† Merian's *Surinam Insects*, p. 24. ‡ St Pierre's *Voyage*, p. 72.
§ Smeathman's *Travels*, p. 32. ‖ Reaumer's *Insects*, vol. ii. p. 344.
¶ *Phytologia*, p. 364. ** *Philosophical Transactions*, vol. xix. p. 451.
†† Pliny's *Hist. Nat.* lib. xvii. c. 54.

this kind, it may have been the grub of another beetle (*Prionus coriarius*), or one of its congenors, which is sometimes found in the oak.* Amoreux has collected various opinions of entomologists on the question respecting Pliny's Cossus, which is supposed to have been the grub of the palm-weevil (*Calandra palmarum*) by Geoffroy; of the stag-beetle (*Lucanus cervus*) by Scopoli; and of *Prionus damicornis* by Drury. Neither *Calandra palmarum* nor *Prionus damicornis* are natives of Italy, and therefore they must be left out of this inquiry; but *P. coriarius* and the stag-beetle (*Lucanus cervus*) are both found there in the oak and in other trees; and either or both of these insects may have been eaten under the name of *Cossus*, and their difference would not be discernible to naturalists nor cooks.† In order to acquire that plumpness which is deemed in the East a beauty, the women of Arabia and Turkey swallow, every morning, three specimens of a *Tenebrio* dug out of the filth of the garden and fried in butter. Curtis says that the Turkish women cook and eat a certain beetle (*Blaps sulcata*) in butter, to fatten themselves.‡ By this time some readers will have shrugged their shoulders and turned up their noses with disgust at the grub-eating epicures, who, it must be observed, are by no means few in number nor peculiar to one locality. There exists no sound reason why grubs, when cleaned and nicely cooked, should not be as proper for the table as poultry, which are so fond of them. When an English traveller expressed his surprise and disgust at some Arabs eating insects, the men justly retorted that it was poor affectation in a person who could swallow raw oysters. The first man that ever made the experiment of swallowing a raw oyster must have been a rare brave fellow; but while we thank him for introducing us to this delicious mollusk, we may regret that he did not display his gastronomic courage upon cockchafers and other small short-horns.

Kirby remarks that "many insects emit very powerful odours, and some produce extraordinary effects upon the human frame; and it is an idea not altogether to be rejected, that they may concentrate into a smaller compass the properties and virtues of the plants upon which they feed, and thus afford medicine more powerful in operation than the plants themselves. It would be worth while to institute experiments to ascertain the truth of this view."§ Several species of beetles are used medicinally. In Europe, the *Lytta*, or *Cantharis vesicatoria*, is an important article, better known by the incorrect appellation of Spanish-fly. It is exceedingly abundant in the southern parts of Europe, particularly in Spain. Numbers of this useful and beautiful beetle are collected

* *Introd. Entom.* vol. i. p. 298.
† Amoreux, p. 154.
‡ *British Entomology*, vol. iv. p. 148.
§ *Introd. Entom.* vol. i. p. 310.

from the leaves of the different trees which they haunt, in June and July, and are then destroyed according to the recommendation of Dioscorides, by the fumes of strong vinegar, and then dried in the sun. They are not only used externally as a vesicatory, but internally as a stimulant and diuretic. Dioscorides, Galen, and Pliny entertained the notion that the *virus* existed only in the body of the beetle, and that the head, feet, and wings contained its antidote. Hippocrates prescribed them internally in dropsy, jaundice, and amenorrhœa; yet in 1693, Dr Groenvelt was cited before the censors of the college of physicians, and committed to Newgate by a warrant from the president, for having administered cantharides inwardly, in the form of pills, for the cure of the stone. He was acquitted, however, on the plea that a bad intention must be proved before criminality can be found in bad practice. This affair ruined him, although he vindicated himself in a small tract entitled "De tuto Cantharidium uso interno," wherein he taught his prosecutors the safety and value of his prescription. Mr G. Munby says, that *Cantharis vesicatoria* is extremely abundant in certain parts of Dijon, in France. "I saw," he says, "an ash-tree hanging over the road so crowded with them, that their excrement literally blackened the ground; and on passing underneath the tree, I felt my face as if bit by gnats. They have a disagreeable sickening smell, which may be perceived twenty or thirty yards off, according to the direction of the wind. They are sold at about six shillings per pound when dried."* At the Entomological Society's meeting, 6th August 1838, Dr Kirby of Spilsby, Lincolnshire, stated that he had found these insects so plentiful in a neighbouring wood, that he had made blistering ointment of them, which was as effectual as that of the London pharmacopœia. In America, where this species is sold at sixteen dollars per pound, two other species (*L. Cinerea* and *L. vittata*), that are there extremely common and noxious, have been substituted for it with great success, and are said to vesicate more speedily, and at the same time less painfully, from their causing no strangury. At a meeting of the Entomological Society, 3d August 1840, Mr Alexander Burn stated that two species of *Cantharidæ* are very abundant in India, and remarked that as they prove as powerfully stimulant as the common officinal species, they might be made a valuable article of commerce. In China, the *Mylabris cichorei* has long been employed for the same purpose. This insect, indeed, seems to have been regarded as the most powerful vesicatory by the ancients, who, however, likewise appear to have been acquainted with the common *Lytta vesicatoria* also, and to have used it, as well as the rose-chafer (*Cetonia aurata*) and some other insects mentioned by Pliny.

* *Mag. Nat. Hist.* vol. ix. (1836) p. 119.

General Hardwicke has described, in the "Asiatic Transactions," another species of *Mylabris* which is plentiful throughout Bengal, Bahar, and Oude, and is quite as efficacious as the common blistering beetle. Dr Clarke relates that the Egyptian women eat the sacred beetle (*Scarabœus sacer*,) believing that it renders them prolific, and hence they adopt it as the symbol of the sun, the fertiliser of the earth. Latreille informs us that *Blaps sulcata*, an Egyptian beetle, is used by the Turks to alleviate pain in the ear, and to cure the stinging of the scorpion. Pliny speaks of a *Blatta*, but from his description it appears to be the churchyard-beetle, (*Blaps mortisaga*,) which he says will, when applied with oil of cedar, infallibly cure ulcers that defy other applications. Blumenbach says that the lady-beetle (*Coccinella*) and a species of oil-beetle (*Meloe*) have been prescribed as cures for the toothach. Mr Newport, an eminent entomological investigator, has ascertained that the common oil-beetle (*M. proscarabœus*) is highly diuretic. A modern Italian professor assures us that the toothach may be cured for a whole year by the application of a finger imbued with the juice of a certain weevil, the *Curculio antiodontalgicus*. Gum-ammoniac, according to Mr Jackson, exudes from the incisions that have been made in the bark of a fennel-like plant by a beetle with a large horn. In some parts of Africa, a kind of soap is manufactured from a predaceous species of beetle, hence named *Carabus saponarius*, by Olivier. The *Cabinet de Lecteur* of June 29, 1836, stated that a society formed at Guedlinbourg had collected nineteen million cockchafers (*Melolontha ruficornis*) for the purpose of extracting oil from them. The experiment had been previously tried in Hungary, and three measures of oil had been extracted from eight measures of cockchafers. The insects were placed in pots of earth, which were covered with straw, and then with network of metallic threads; then the whole was placed upside-down on a heated utensil destined to receive the oil, which flowed from the insects. This oil, it was expected, would prove particularly serviceable in greasing wheels, &c.

The Chinese ladies embroider and adorn their dress with the elytra or wing-cases of a brilliant species of beetle (*Buprestis vittata*.) In Chili and the Brazils, splendid necklaces are formed of golden-tinted weevils (*Curculionidœ*) and of certain other beetles (*Chrysomelœ*.) At Rio de Janeiro, a rather lucrative trade is carried on in brilliant beetles, which are sold at fourteen shillings per hundred, being purchased for the sake of their pretty wing-cases, now employed to adorn the ladies of Europe. The diamond-beetle is in great request for gentlemen's brooches, and ten piastres are often paid for a single specimen. In some parts of the Continent, the burnished violet-coloured thighs of the dorr beetle (*Geotrupes stercorarius*) are strung together for the same purpose; and it is remarkable that similar necklaces, made of several specimens of a

small species of *Scarabæus*, are frequently found on the Egyptian mummies.*

Several species of luminous insects are used instead of candles in various parts of the world. Among the beetles so employed, the most distinguished is the phosphorescent click beetle (*Elater noctilucus.*) "It is called *cocujas* in South America, where it is not uncommon; it is about an inch and a half long, of a brown colour, with the thorax marked on each side by a smooth, yellow, transparent spot, highly luminous, and diffusing so brilliant a light at night, that a person may, in a favourable position of the insect, see to read the smallest print. Besides these, however, there are two luminous spots beneath the elytra, or wing-cases, only visible, of course, when the insect is on the wing, and then it appears studded with four rich and vivid gems of a blue lustre; in fact, the whole body seems a flood of pure light. In the West Indies, particularly at St Domingo, the natives employ these insects to give light in managing their household concerns. In travelling they are wont to attach one to each toe; and it is stated that in fishing and hunting they require no other light. Pietro Martire informs us that this beetle serves the natives of the Spanish West Indies not only as a light to illuminate their houses but to extirpate the gnats; on introducing the fiery beetles the gnats become their prey. On festive days these beetles are collected and attached to their clothes and horses; and, according to the same author, the luminous matter is sometimes rubbed over the face. We are told by Mouffet that the appearance of the tropical fiery beetles on one occasion led to a singular result. When Sir Thomas Cavendish and Sir Robert Dudley first landed in the West Indies, the flitting and moving lights of these insects in the woods impressed them with the idea that the Spaniards were advancing, and they returned in consequence to their ships.† Eight or ten of these insects put into a phial will yield a light equal to that from a common candle; and it is said that this was the only light used by the natives of Hispaniola, &c., prior to the arrival of the Spaniards."‡ This species is not the only one of the genus that is used in this way. We are told that the ladies in India inclose the fiery beetles in gauze, and thus carry them in their hair when they take their evening walks. Mrs Ashmole says that at night-time the fiery beetle will cause some alarm to the stranger in India, when its bright glow is discovered amidst the folds of a delicate white muslin garment.§ Mr Turnbull tells us that luminous insects are numerous in Cuba, and that a dozen of the large fiery beetle, called the *cocuyo*, will, when enclosed in a cage, emit so much light, of a brilliant green colour, as

* Wild's *Narrative* (1840.) † *Insectorum Theatrum* (London, 1634,) p. 112.
‡ Murray's *Researches in Natural History* (1830,) p. 121.
§ Mrs Ashmole's *Three Months' Residence in India* (1841.)

to enable you to read by it; and that the late clever and eccentric Mr Joseph, of Trinidad, is stated to have written several volumes by this light. The insects, he adds, may be preserved alive for three months or more, provided they are frequently bathed, and their favourite food—a piece of sugar-cane stripped of its bark—renewed at least daily.*

Southey has given an accurate and spirited description of the fiery beetle:—

> Soon did night display
> More wonders than it veil'd; innumerous tribes
> From the wood-cover swarm'd, and darkness made
> Their beauties visible. One while they stream'd
> A bright blue radiance upon flowers that closed
> Their gorgeous colours from the eye of day;
> Now, motionless and dark, eluded search,
> Self-shrouded; and anon, starring the sky,
> Rose like a shower of fire.—*Madoc.*

Accuracy is seldom, however, to be found in poetical notices of insects; and the famous poetess, Mrs Barbauld, is very incorrect in saying

> Some shoot like living stars athwart the night,
> And scatter from their wings a vivid light.

And, not content with perpetrating this error, she proceeds to sing of a beetle

> —— whose rich treasury swells with hoarded grain.

a nondescript species of her own creating.

Mr Edward Doubleday says that no luminous *Elater* is found in New Jersey, North America, all the fiery beetles there being of the genus *Lampyris*, and of which he thought he could detect three, if not four species. They begin to be common about the end of June, and seem constantly to emit a light, but so faint that, unless near it, it is not discernible. At intervals of two or three seconds, they emit a vivid flash like that of a rifle. This flash is generally whitish, sometimes reddish, and at other times greenish; and Mr Doubleday is inclined to regard this variation of colour as indicative of different species. "It is amusing, though difficult," says he, "to chase these fiery beetles. You see a flash, and then another, and dash forward in the apparent line of the insect's course; but the creature is too cunning for you—he has turned short, and is flashing away to the right or left far beyond your reach. In the hand the flashing is dazzling. I have sought in vain to discover the mode in which it is produced, but I had no glasses sufficiently powerful to be of any service in dissecting the insect." †

The ladies in Italy ornament their hair with specimens of another luminous species (*L. Italica.*) The Rev. W. B. Clarke says that

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* Turnbull's *Travels.*

† *Entomological Magazine*, vol. v. (1837,) p. 31.

fiery beetles are so abundant near Vivas and along the Jura, that a party of young ladies came into his hotel, in July 1825, with their head-dresses decorated with dozens of these living jewels, which they had collected for amusement in the course of their walk. He adds, that one species is very numerous in the ruins of Rheinfels, on the Rhine, near St Goar, where, in a dark warm evening in summer, they quite illuminate the air under the shady trees that border the steep ascent to the castle; and he expresses his surprise that Lord Byron, in describing the evening landscape in these localities, has not alluded to the brilliant beetles.

II. *Orthoptera.*—The locust tribe, the most destructive of this order of insects, is extensively eaten by numerous nations; and, curious enough, the generic name of the locusts—*Gryllus*—sounds like an invitation to cook them. They have been the food of man from the earliest period; and some tribes of Ethiopians were so attached to this kind of diet that they were named *Acridophagi*, or locust-eaters.* They are expressly mentioned among the things permitted to be eaten under the Mosaic dispensation.† The Parthians, according to Pliny's account, held them in high esteem.‡ It was common to eat them in Palestine and the neighbouring countries. Shaw, Niebuhr, Russell, and many other travellers in the East, represent their taste as agreeable, and inform us that they are frequently eaten. We are told by Shaw, that when they are sprinkled with salt, and fried, they taste not unlike our fresh-water crevice, vulgarly called *cray-fish*.§ Russell tells us that the Arabs salt and eat them as a delicacy, and Niebuhr says they gather an abundance of them, which they dry and keep for winter provisions. Hasselquist learnt that, when corn is scarce in Mecca, the Arabs obtained a substitute for flour by grinding locusts in their hand-mills, or by pounding them in stone mortars; that by mixing this flour with water they made cakes, which they baked in the same way as they do their common bread. It is not unusual for them, he says, to eat locusts when there is no famine, but then they boil them well in water, and afterwards stew them with butter, and so form a fricassee of no bad flavour.‖ Leo Africanus, as cited by Bochart, gives a similar account.¶ In the *Life of a Travelling Physician*, we read that the Syrians in times of famine produced by locusts, grind the dried bodies of these insects, knead them into a cake, and so eat them. The author remarks that it would seem incredible that any person would, by preference, eat locusts, from whose mouth oozes, upon the least pressure, a dark viscid fluid; yet

* Diodorus Siculus, lib. iii. c. 39; Strabonis Geog., lib. xvi., &c.

† See *Leviticus* xi. 22, and *Matt.* iii. 4. ‡ *Hist. Nat.* lib. xi. c. 39.

§ This animal is not a fish, but a crustacean. *Crevice* (probably from the French *écrivice*) was its ancient name in England; and, as it does not mislead, should be restored to the language.

‖ Hasselquist's *Travels*, p. 232. ¶ Bochart, *Hieroz.* vol. ii. lib. xiv. c. 7.

he knew a nobleman of high rank and consideration, who, wishing to imitate St John in the wilderness, amused himself by eating these insects and wild honey. Bullock says that in the Levant the largest species of locusts are sold as food, and that the females of them are most sought for as being very nutricious. The unfortunate Bushmen, and even the Colonial Hottentots, consider locusts a great luxury, consuming great quantities fresh, and drying abundance for future emergency.

> Yea, even the locusts' wasting swarm,
> Which mightiest nations dread,
> To me brings joy in place of harm,
> For I make of them my bread.
>
> PRINGLE'S *Song of the Wild Bushman.*

The Hottentots, according to Sparrman, eat great quantities of locusts, which visibly fatten them, and they make a coffee-coloured soup of their eggs; hence these poor wretches rejoice when the locusts arrive in their country, although these voracious insects destroy all its verdure. The same traveller tells us that they believe the sudden swarms of locusts originate from the good-will of a great master-conjuror in the far north, who, having removed a stone from the entrance to a certain deep pit, let loose these insects to be their food.* A curious coincidence with this notion of the Hottentots is to be found in the Apocalypse, where the symbolical locusts are said to have emanated from a pit which an angel opened.† Clenard states in his letters, quoted by Bochart, that waggon-locusts are brought to Yez as a common article of food.‡ Kirby and Spence were informed by Major Moor that when a cloud of locusts visited the Mahratta country, the common people salted and ate them. This mode of dressing them used also to be adopted by many of the ancient African nations, some of whom also used to smoke them.§ Even in the markets of Greece they seem to have been sold as food.‖ When Jackson was in Barbary in 1799, dishes of locusts were generally served up to the first tables, and esteemed very delicious.¶ The Moors, who prefer them to pigeons, reject the heads, wings, and legs of these insects, which they usually boil in water half an hour; having done so, they fry them with salt, pepper, and a little vinegar. The Rev. R. Sheppard caused some of our common green locusts, or field crickets, (*Acrida viridissima*,) to be cooked in this way, but substituting butter for vinegar, and found them to be excellent food. From an ignorance of the ancient and still very general custom of eating locusts, and of the esteem in which they were and are yet held as delicious food in the East, some commentators would have us

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* Sparrman, vol. i. p. 367. † *Revelation* ix. 2, 3.
‡ Bochart, *Hieroz.* vol. ii. lib. iv. c. 7, p. 492. § Pliny's *Hist. Nat.* lib. vi. c. 30.
‖ Ibid. ¶ Jackson's *Travels in Morocco*, p. 53.

believe that the locusts which John the Baptist ate with wild honey, in the wilderness, were not these insects, but the fruit of the locust-tree. Whether it be a passage in the Bible or one in Shakspeare, it has the same fate from a certain class of commentators—they will mystify it if they can, and so make the reader who sought information declare, with the poet—

> The more he reads, the more perplex'd—
> The comment ruining the text.

In the present case, the majority of readers will conclude, as Hasselquist and other high authorities have, that John the Baptist found sustenance in the insects called locusts; and this conclusion will be questioned only by those who, in the spirit of fastidious refinement, and in the obscurity of ignorance, think that insects could surely not have been fit diet for a holy character. But, we repeat, at the present day in Persia, Arabia, and elsewhere, locusts are fried until their wings and legs fall off, and are then eaten with rice and dates, sometimes flavoured with salt and spice; and *wild honey* is found in the clefts of the rocks in Judea as abundantly as in the caves of Hindostan. Mr Swainson, after remarking that locusts in general are not only wholesome, but palatable to many persons, adds that the natives of Africa regard as delicious food the roasted females of a certain kind of cricket when full of eggs, which are inclosed in a bag, and resemble a fish's roe. At the proper season the children are always busily employed in digging these pregnant specimens out of the earth, to gratify the palates of themselves and parents.* The Greek poor were accustomed to feed on grasshoppers.† The Spaniards are so fond of hearing the chirping of grasshoppers, that the nobility and gentlefolks keep these insects in cages, which are thence called *grilleria*. This reminds one of the ingenious Irishman who inclosed a cricket in a sham watch:—

> Bryan O'Lynn had no watch for to bear,
> So he got him a turnip, and scoop'd it out fair,
> He then put a *cricket* clane under the skin,
> They'll think it's a-ticking, says Bryan O'Lynn.

III. *Neuroptera.*—Scopoli tells us that the multitudes of *Ephemeræ* which in June emerge from the river Laz, in Carniola, are collected by the husbandmen as manure, who think they have not fared well unless they have each procured at least twenty loads. The gregarious insects, improperly called white *ants*, (*Termites*,) make some amends for their occasionally severe ravages, by affording, in their own little persons, an abundant supply of food to some African nations; they are eaten either raw or boiled by the Hottentots, some of whom get into good condition upon this diet.‡

* Swainson's *Geographical Distribution of Animals*, (1835,) p. 99.
† *Arts of the Greeks and Romans*, vol. i. (1833,) p. 178.
‡ Sparrman, vol. i. p. 363.

Konig, as quoted by Smeathman, says that the natives of some parts of the East Indies make two holes in the white-ants' nest—one hole to the windward, and the other to the leeward, placing at the latter opening a pot, (previously rubbed with an aromatic herb,) to receive the insects as they make their way out of the nest, in order to escape from the foul fumes and smoke applied at the opposite aperture. In this way the natives capture great quantities of white ants, which they mix up with flour, and so produce a kind of pastry, which is purchased, at a cheap rate, by the poorer people. Captain Green relates that, in the ceded districts of India, the natives place over the nests the boughs of trees, and then smoke out the insects, which, in attempting to fly, break their fragile wings against the branches, and so fall an easy prey. Smeathman says he did not find the Africans so ingenious in obtaining or dressing the white ants. It seems that they content themselves with obtaining, by the aid of their calabashes, a very small portion of the numbers of white ants that fall into the waters when these insects swarm. Having filled their large kettles with them, they carry them home, and there parch them in iron pots over a slow fire, stirring them about, as is done in coffee-roasting. In this condition, without sauce, or any other adjunct, they are served up to table, and eaten by handfuls, as delicious food. Smeathman often ate them dressed in this way, and he found them to be delicate, nourishing, and wholesome; sweeter than the *gru-gru*, or palm-tree grub, and resembling in flavour sugared cream, or sweet-almond paste.* The Hindoos suppose that the female white ant, in particular, possesses highly nutritive properties; and Mr Broughton says that she was most carefully sought after, and preserved, for the use of the debilitated Surgee Rao, prime-minister of Scindia, chief of the Mahrattas.†

IV. *Hymenoptera.*—Although the galls of commerce are essentially of a vegetable nature, yet they owe their origin to what are called gall-flies, and therefore we may fairly include these substances among the products of insects. Galls arise from punctures which the female gall-fly (*Cynips*, of which there are numerous species) makes in various parts of plants, shrubs, and trees, that she may deposit her eggs therein; inserting, generally, but one egg in each puncture. At such parts the plant assumes unusual forms—the egg, or the the hatched grub, of the fly becoming surrounded by a vegetable growth, of a firm texture, generally globular, and mostly possessing, at first, a bright, healthy colour, like that of young bark or fresh fruit. This production continues to grow on all sides during the sojourn of the grub within it. The operating cause of the growth of the gall, and of the regularity of its form, does not appear to be clearly understood by either entomologists or botanists; but there is positive proof that none of these galls are produced without the

* Smeathman, p. 31.

† *Letters written in a Mahratta Camp, in* 1809.

presence of the insects. What is objectionably called the *oak-apple* is a gall of this kind; and if cleft in two at the proper time, the grub of the gall-fly will be discovered reposing in the central chamber of it. Those galls which different species of gall-fly produce on three species of sage (*Salvia officinalis*, *triloba*, *and pomifera*,) are very juicy, and crowned with rudimentary leaves, resembling the calyx of a young apple. In the Levant, these sage galls are highly prized for their aromatic and acid flavour, especially when prepared with sugar. They constitute, in fact, a considerable article of commerce from Scio to Constantinople, where they are regularly sold in the market.* Dr Lankester, referring to these galls, says, that those which project from the branches of the *Salvia pomifera*—a species of sage of peculiar growth, and common to the Greek islands, —are called sage-apples, and are supposed to be produced by the puncture of a gall-fly. They are about three-quarters of an inch in thickness, of a fleshy appearance, and semi-transparent, like jelly. They are constantly exposed for sale in the markets of Greece, where they are made into a kind of conserve, which is highly esteemed.† Dr Clarke assures us of the excellence of this delicacy, with which he was regaled by the English consul at the island of Syros.‡ In France, the galls of ground-ivy have been eaten; but Reaumer, who tasted them, doubts that they will ever become a part of the dessert. The *nut-galls* which are so extensively used in the black-ink manufacture, arise from the punctures which a certain species of gall-fly (first described by Olivier, under the name of *Diplolepsis gallæ tinctoriæ*) makes in the leaves of a species of oak (*Quercus infectoria*, Oliv.) very common throughout Asia Minor, where, in many places, these galls are collected by the poorer people, and exported at Smyrna, Aleppo, and other ports in the Levant, as well as from the East Indies, whither a part of those collected are now carried. The oak-galls most prized are those commonly known as *blue* galls, being those gathered at an early period—that is to say, before the gall-flies have been disclosed from the galls. Those of the second gathering, from most of which the insects have made their escape, are called *white* galls, and are of an inferior quality, containing one-third less of the astringent principle than the blue galls. Both the white and the blue galls are usually imported mixed in about equal proportion, and in this state are called *galls in sorts*. To the dyer, galls are important materials for imparting a black colour to garments and other articles. This can, indeed, be accomplished without the use of galls; yet, notwithstanding all the improvements in the art of dyeing, galls are found to offer at once the cheapest and most effectual means. Molina tells

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* Smith's *Introduction to Botany*, p. 346; Olivier's *Travels*, vol. i. p. 139.

† *Vegetable Substances used for Food*, (1832) p. 321.

‡ Dr Clarke's *Travels*, vol. vi. p. 100.

us that in Chili an oil is obtained from the large globular cellules found upon the wild rosemary, and which are supposed to be galls produced by the punctures of a gall-fly. In the East, the west of Europe, the Levant, and Greek islands, certain species of gall-flies are of great use in assisting the ripening of the fig (*Ficus carica.*) "The fig consists of a pulp, containing a number of seed-like pericarps, inclosed in a rind. It has no visible flower, for the fruit arises immediately from the joints of the tree, in the form of little buds, with a perforation at the end, but not opening or showing any thing like petals, or the ordinary parts of fructification. As the fig enlarges, the flower comes to maturity in its concealment; and in some countries the fruit is improved by a singular operation, called *caprification.* This is performed by suspending on threads, above the cultivated figs, branches of the wild fig, which are full of a species of gall-fly. When the insect has become winged, it quits the wild figs, and penetrates the cultivated figs, for the purpose of laying its eggs; and thus it appears both to ensure the fructification, by dispersing the *pollen*, and afterwards to hasten the ripening, by puncturing the pulp, and causing a dispersion or circulation of the nutritious juices." * A second crop is also obtained by this means, but is thought to deteriorate the fruit. In France, the effect of caprification is gained by puncturing the figs with straws dipped in olive oil.

In seasons of scarcity, the Bushmen of the Orange River subsist, in great measure, upon ants and their larvæ. Piso says, that in Brazil the abdomens of yellow ants, called *cupia*, are eaten by many persons; and also a large species, under the name of *Tamajoura.*† This statement is confirmed by Humboldt, who says that the Maravitanos and Margueritaries mix ants with resin, and so eat them as a sauce. In Siam ants' eggs, which are not much larger than grains of sand, are a costly luxury, being sent to table curried, or rolled in green leaves, mingled with very fine slices or shreds of fat pork. It is well known to chemists that ants secrete a pleasant kind of vinegar, or a peculiar acid, called formic acid. Consett says, that in some parts of Sweden, ants are distilled along with rye, to give a flavour to the inferior kinds of brandy; and he mentions a young Swede who sat down with avidity to make a repast at an ant's nest.‡ Speaking from their own experience, Kirby and Spence declare that, instead of ants having any unpleasant flavour, they are very agreeably acid, and that the trunks of their bodies have a different taste to that of their abdomens.

A certain species of ant (*Formica bispinosa*, Oliv.; *F. fungosa*, F.) collects from the Bombax and silk-cotton tree a kind of lint, which, as a styptic, or stancher of blood, is preferable to the puff-

* *Vegetable Substances used in the Arts*, (1829) p. 243.
† Piso, *Ind.* lib. v. c. 13, p. 291. ‡ Consett's *Travels in Sweden* (1789) p. 118.

ball (*Lycoperdon.*) At Cayenne this lint is taken from the ants, and successfully used to stop even the most violent hæmorrhages. A traveller, whose name and that of the country of which he speaks, I have unfortunately omitted to preserve, says, "It is customary here to apply, at the commencement of the *goître*, poultices of warm gourds, the patient at the same time drinking water which has stood for several days upon a pounded mass of large ant-hills. The component parts of these ant-hills, which are from 5 to 6 feet high, in the construction of which the insects make use of a peculiar animal slime as a cement, certainly seem capable of counteracting the causes which produce that frightful disease. Perhaps, too, the acid of the ants may have a beneficial influence on relaxed nerves of the patient, as well as on the debility of the lymphatic system."

In America it is not uncommon for a nest of hornets to be suspended in the parlours, that they may destroy the flies and gnats which are very troublesome to the inhabitants. Reaumer states, that the French butchers are glad to have wasps about their stalls, for the purpose of driving away the blow-flies. In our own country wasps do us some service in destroying great numbers of tormenting flies and moths.

Knox informs us that bees are eaten in Ceylon.* Gilbert White mentions a poor idiot boy, who, from his childhood, showed a strong propensity for eating honey-bees, humble-bees, and wasps, wherever he could find them. He had no apprehensions from their stings, but would seize them in his naked hand, and at once disarm them of their weapons, and suck their bodies for the sake of their honey-bags. He was wonderfully adroit in the pursuit of these insects, and when he ran about, he used to make a humming noise with his lips, resembling the buzzing of bees. He was very injurious to bee-keepers; for he would enter their gardens, and, sitting down before the stools, would rap with his finger on the hives, and so take the bees as they came out. He had been known to overturn hives for the sake of honey, of which he was passionately fond.

The space forbids us to pursue the subject further for the present.

Origin of various Plants. (From the German.)

Wheat was brought from the central table-land of Thibet, where its representative yet exists as a grass, with small mealy seeds.

Rye exists wild in Siberia.

Barley exists wild in the mountains of Himalaya.

Oats, wild in Northern Africa.

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* Knox's *Ceylon*, p. 25.

Millet, one species is a native of India, another of Egypt and Abyssinia.

Maize was brought from America.

Canary seed, from the Canary Islands.

Rice, from South Africa, whence it was taken to India, and thence to Europe and America.

Pease are of unknown origin.

Lentil grows wild on the shores of the Mediterranean.

Vetches are natives of Germany.

Chick pea was brought from the South of Europe.

The Garden-bean, from the East Indies.

The Horse-bean, from the Caspian Sea.

The Lupin, from the Levant.

Buck Wheat came originally from Siberia and Tartary.

Rape-seed and *Cabbage* grow wild in Sicily and Naples.

The *Poppy* was brought from the East.

The *Sunflower*, from Peru.

Flax or *Linseed* is, in Southern Europe, a weed in the ordinary grain crops.

The *Radish* came from China.

The *Garden Cress*, out of Egypt and the East.

Hemp is a native of Persia and the East Indies.

The *New Zealand Flax* and *Syrian Swallow wort* show their origin by their names.

The *Nettle*, which sometimes furnishes fibres for spinning, is a native of Europe.

Of *Dye-plants*, the *Madder* comes from the East.

Woad is a native of Europe.

Dyers-weed grows in Southern Germany.

Safflower came from Egypt.

Dyer's Knotgrass, from China.

Hops come to perfection as a wild plant in Germany.

Mustard and *Carraway-seed*, the same.

Dill is an Eastern plant.

Anise was brought from Egypt and the Grecian Archipelago.

Koriander grows wild near the Mediterranean.

Saffron came from the Levant.

The *Onion*, out of Egypt.

Horse Radish, from South Europe.

White Melilot, from Greece.

Chickory grows wild in Germany.

Tobacco is a native of Virginia and Tobago; another species has also been found wild in Asia.

Fuller's Teasel grows wild in Southern Europe.

The *Grasses* are mostly native plants, and so are the *Clovers*, except *Lucern*, which is a native of Sicily.

Spurry is a European plant.

The *Gourd* is probably an Eastern plant.

The *Potatoe* is a well-known native of Peru and Mexico.

Jerusalem Artichoke is a Brazilian product.

Turnip and *Mangold Wurzel* came from the shores of the Mediterranean.

Kohlrabi and *White Turnip* are natives of Germany.

The *Carrot* is by some supposed to have been brought from Asia, but others maintain it to be a native of the same country as the turnip.

The *Parsnip* is also supposed to be a native of the same place.

Amongst other kitchen-garden plants, the *Spinach* is attributed to Arabia.

The *Garden Orache*, to Tartary.

The *Radish*, to China and Japan.

The *Cucumber* came from the East Indies.

The *Melon*, from Kalmuck.

Parsley grows in Sardinia.

Tarragon, in Central Asia.

Celery, in Germany.

Of *Fruit Trees* and *Shrubs*, the *Currant* and *Gooseberry* came from Southern Europe.

The *Medlar*, *Pear*, and *Apple* are likewise European plants.

The *Cherry*, *Plumb*, *Olive*, and *Almond* came from Asia Minor.

The *Mulberry Tree*, from Persia.

The *Walnut* and *Peach*, from the same country.

The *Citron*, from Media.

The *Quince*, from the Island of Crete.

The *Chestnut*, from Italy.

Of *Forest Trees* the majority are native plants, except the *Pine* and *Horse Chestnut*, the former of which was brought from America, and the latter from Thibet.

The *Hurtleberry* is a native of both Asia and Europe.

The *Cranberry*, of Europe and America.

*[illegible]oddart's Angler's Companion.**—The lovers of the gentle art [illegible]not fail to be gratified by the perusal of this volume. It is from [illegible]e pen of an individual not altogether unknown to them, for he [illegible] made a previous effort to please and instruct them by the pub[illegible] of a small work, named the Scottish Angler. If, in the [illegible]erval of a dozen years which has since elapsed, the author's fancy [illegible] less buoyant, and his muse less ready to unfold her [illegible]ned largely in experience and there is still no [illegible] colouring to adorn [illegible] scenes [illegible]

* [illegible]

describes. He has been an enthusiast in angling; what to most others is merely a recreation, seems with him to have formed almost the business of his life. Since the publication of his former work, he tells us that he has pursued it with a measure of enthusiasm little inferior to that which actuated his boyish years; "and were I to relate instances," he adds, "in order to prove my attachment to river-side recreations, I should only excite the wonder of many 'grave and reverend signiors' who draw their life and enjoyment from very different, but to me, unenvied sources."

The information and practical skill thus obtained must necessarily be extensive, varied, and useful, and the result is embodied in the handsome volume now before us. Besides the more technical and descriptive portions, much interesting reading of a more general kind will be found, consisting of piscatorial anecdotes, statistical notes, and descriptions of loch and river scenery. Indeed, a rapid survey is taken of all the principal lochs and rivers of Scotland, and an endeavour made to appreciate their value as angling stations; and, to render the subject complete, we are supplied with useful directions for cooking salmon and other kindred kinds of fish—a matter which is generally very little understood.

Of the multitude of works which have been published on angling, we find very few that have contributed much to extend our knowledge of the natural history, properly so called, of fresh-water fishes. This has perhaps often proceeded from ignorance of the points which remained uncertain, and which it was of importance to determine; and often also from want of opportunity or inclination to undertake any patient investigation by those who had recourse to angling merely as a sport or agreeable recreation. Still it is very desirable, even with a view to successful angling, that the history of our fresh-water fishes should be well understood; as a matter of economy it is most important; and it is most interesting as enlarging our views of a class of animals whose habits and proceedings are so different from those which we have better opportunities of observing. What Mr Stoddart has done in this way might have been done more satisfactorily—still it may be of considerable utility. The fish he mentions under the name of swallow-smolt, is either a well-marked variety of the common trout, or a distinct species. It appears to have considerable claims to be regarded in the latter light, but Mr Stoddart's description is far too general to determine the point. He considers it to be confined to the Tweed. Its appearance resembles, in some respects, that of the bull-trout; the head is large, the teeth particularly strong, the maculæ irregularly but profusely distributed, the whole formation that of a powerful and rapacious fish. Its average weight is from two to four pouuds, but individuals have been caught that weighed nearly half a stone. The flesh is coarse and rank flavoured. It is of highly predatory habits, and seldom, if ever, rises to the artificial fly. The occurrence of the red

spots may be regarded as a proof of its connexion with the common trout, and when we consider the endless varieties of that species, we will be inclined to regard it as one of them.

We are not aware that the young of our three migrating salmonidæ have been hitherto accurately discriminated. In this state they are all very like each other; they likewise bear a very close resemblance to the fry of the trout, and are commonly confounded under the general name of parr. No sooner, however, have they undergone the first change and assumed the smolt dress, (which, in the Tweed, takes place from the middle of March nearly to the end of April,) than they present certain marks of distinction, which seem to be well known to the anglers of that river. They are "the black-fin or salmon smolt, the orange-fin or whitling, and the gray-fin or bull-trout smolt. Of these the last mentioned far surpasses in size the two others. I have caught them weighing five ounces, and equal in strength and activity to river trout of nearly twice that weight. The orange-fin, in this respect, ranks next, and the black-fin or true parr-smolt, is the smallest of all. In Tweed itself, the real salmon smolt abounds more than the others, but in its tributaries, which are spawned in by vast numbers of sea-trout and whitlings, the fry of these fish greatly exceed that of the salmon." (p. 210.) It is much to be wished that Mr Stoddart had described these three smolts more at length, and made us acquainted with other marks of distinction, which doubtless may be detected, besides those vaguely referred to by the respective names. Is it not somewhat remarkable that the smolt which ultimately becomes the largest fish of the three, should at this stage be the smallest?

Every one is acquainted with the method in which fishes are supposed to propagate. It has long been considered an established fact in their natural history, that the female deposits her ova, and that these are impregnated, after extrusion, by the milt of the male being shed over them. No one has called this in question till very lately; but the experiments of Mr Shaw having led to some singular and startling conclusions, some individuals, and among others the author of the present volume, have been led to doubt the accuracy of the generally received opinion. They allege that an act of copulation takes place between a mature milter and spawner; that the spawn cannot be fertilised otherwise than by this connexion; and that the time when this occurs is after the completion of the spawning process, (in fish previously impregnated,) when the females are in the condition of what are called kelts. It is not an impregnation of the shedded or flowing ova that takes place, according to Mr Stoddart, but an impregnation of the ovaria after spawning; and this for the purpose of endowing or fructifying the next year's deposit. Pairing is alleged to occur only for the occasion; and from the circumstance of a much smaller number of male fish being found in the Tweed than the other sex,—the proportion being

nearly one to three,—it is conjectured that the same milter will serve several females in succession, according as they are in a state of preparation to receive him. The male fish, which is commonly observed hovering near a female while she is on the redd, jealously driving off all intruders, is not supposed to be waiting for the purpose of impregnating the ova, but for paying his addresses to her after that operation has been completed.

These views, it is admitted, are purely hypothetical, and have not been tested by actual experiment. Mr Stoddart endeavours to support them by various considerations:—

In the first place, he says, I hold it to be, as regards the laws of nature, a palpable anomaly, that no direct act of coition should be considered to take place betwixt the milter and spawner, and *that* long previous to the effusion of the ova. It is scarcely an argument to assert that fish are deficient in the organs which alone can render them capable of performing the act. Why, worms and serpents are, to all appearance, more scantily provided with such organs than they are; and yet, as is well known, these, and in fact every insect and reptile, as well as every beast and bird on our terrestrial globe, have necessary recourse in order to promote the extension of their species to acts of coition. It is no matter whether viviparous or oviparous, the communication of a generative power among all these animals is dependent, in every instance, upon the completion of a certain process implicating direct intercourse between the sexes. But are fishes really unprovided with the copulative organs necessary for such intercourse? Are salmon, in particular, both male and female, defective as to their developments? I deny it. Examine a kipper or he-fish in his rank or ripe state, and you will find him distinctly set off with the adjuncts in question. The female also is plainly provided with her receptive sheath, and this is particularly noticeable in her after spawning, at the period when copulation takes place.—p. 189.

There are facts which completely disprove the assertion here made, that coition is in every case necessary for propagation. No coition, properly so called, takes place in toads and frogs, because the male is absolutely destitute of organs for such a purpose; and the whole process of breeding in these reptiles has been so carefully watched, among others by Swanmerdam, the most lynx-eyed and indefatigable observer that perhaps ever lived, that it is perfectly well understood. To suppose, therefore, as Mr Younger has done,* that the male takes his place on the back of the female to be ready for a new impregnation after the ova are expelled and separated from her, is to oppose conjecture to the best ascertained facts. The tritons, or aquatic salamanders, have nothing like a copulation. Their ova are impregnated by the sperm which is shed in the water, and which penetrates along with the water into the oviducts, from which they issue in long strings.†

We are not prepared either to confirm or deny Mr Stoddart's statement as to the existence of developed generative organs in the male salmon; but it is a fact, which it would have well answered his purpose to adduce, that certain kinds of fish propagate their kind by the injection of the male sperm into the ovaria of the female,

* See this *Journal* for January 1847, p. 502. † Cuvier, *Règne Animal*, t. ii. p. 115.

although the former are to all appearance destitute of organs capable of effecting this. A considerable number of fishes are viviparous—that is to say, the young are hatched in the body of the mother—and born alive. One of the most familiar examples of this mode of breeding is to be found in the viviparous blenny, (*Zoarchus viviparus*,) a fish of frequent occurrence along the sea-coasts of Scotland. The young are so matured at the time of birth that they can swim about with ease as soon as they are expelled. Two or three hundred are sometimes produced by one individual, and the abdomen is so distended before parturition, that it can scarcely be touched without extruding them. Now in this, and all similar cases, it is obvious that there must be impregnation while the ova are yet in the ovarium. It is difficult to say how this is effected, for no external apparatus whatever can be observed in the male blenny, although it has been minutely examined for the purpose.

We are not, therefore, entitled to conclude, as Mr Stoddart justly observes, from the appearance of the generative apparatus in the salmon, or even its apparent absence, that there is a physical impossibility of the sperm being conveyed to the ova while they are still *in situ*.

It is well known that the male salmon sheds his milt over the ova after they are expelled,—he is even seen in the act of doing so,—and on the supposition that it is not for the purpose of fertilising them, what object does it serve? Mr Stoddart, and those who are inclined to adopt his views, regard it merely as an investing unguent, causing the roe to adhere together, promoting or preserving its heat, and helping to protect it. "What is alleged actually to take place? Simply this, that two bodies disagreeing severally in their nature and gravity, one being a fluid or semifluid, having no concentrated form, and not possessed of any redundant weight sufficient to overcome that of the element it is presumed to be shed in—the other a solid, consistent as to shape, and remarkable as to heaviness,—that these bodies, so different as regards their specific gravity, and notwithstanding the intervention of a resisting and decomposing medium, like water, approach and come into contact with each other: again, that this contact of the milt with the ova, of a light creamy mote or particle, with a thick husk or shell, is impregnation,—that it operates as having conveyed the vivifying power to the roe-pellets, and that, without such inoculation, these pellets will remain inert and lifeless. Can any thing, I repeat, be so utterly absurd as this detail of the process?"—p. 195. Yet we have seen that such a mode of impregnation actually takes place, and if in one instance, it may in others. While in utter ignorance of what impregnation essentially consists, it is presumptuous for us to say how it may, or how it may not, be effected. It may be accomplished, and in some cases it appears to be so, by means which to us appear altogether inadequate—by a mere effluvium, the most

insensible emanation. But if the matter which exudes from the male is intended for the protection of the ova, as the advocates of internal impregnation (if we may so express it) maintain, this implies that it must invest them closely, and this contact is sufficient to impart the vivifying principle, supposing it to reside in that exuded matter.

Mr Shaw is of opinion that parr remain in that state two seasons. Mr Stoddart's observations on those of the Tweed and other salmon rivers, lead him to believe that their abode in the fresh water is much shorter. In consistency with his theory of impregnation, the latter supposes that the early maturity of the male parr, which is well known to have its generative secretions in a state of remarkable forwardness, is for the purpose of enabling him to vivify the ovaria of his cotemporaneous mate before they repair to the salt water—thus anticipating her return from the sea as a grilse, to deposit, not a bed of inert slough, but active and endowed spawn. "Can there be a solution of the subject more natural or consistent? Does it not at once account for the startling and extraordinary results which apparently attended Mr Shaw's experiments with the milt of the he-parr?"

But our author is scarcely disposed, at all times, to do justice to Mr Shaw. After relating his experiment, by which the milt of a parr was found to fertilise the ova of a full-grown salmon, Mr Shaw proceeds to state that, by way of varying the conditions, he placed ova, without impregnation with parr sperm, in a stream of pure water, and that they remained, as he anticipated, unproductive. Could there be a fairer method of ascertaining the truth? Supposing the parr sperm to have been the cause of fertility in the one case, was the experimenter not entitled to anticipate that the want of it would occasion infertility in the other? This was the only logical and legitimate inference: it was the only result which, from the former experiment, could be anticipated. The purpose for which the experiment was made was fully answered.

The averment in the note in question, says Mr Stoddart, I hold fairly to be open to challenge, upon the ground that it is, in fact, a slurring over of one of the most important points connected with the breeding of salmon, and also because it embodies an admission, on the part of Mr Shaw, which is very apt to impress one with the idea that the experiment under detail was imperfectly, if not carelessly conducted. I allude to the insertion of the words, 'as I anticipated,' which phrase plainly indicates that Mr Shaw had made up his mind to meet with but one fixed result to the experiment, although upon what grounds he had done so, apart from mere prejudice, he has not thought fit to enlighten the reader.—p. 189.

What is this but to say, that Mr Shaw's experiment did not demonstrate what it was never intended nor calculated to demonstrate? But it demonstrates one fact, and that is, that the female salmon in question had not been previously impregnated, which, on Mr Stoddart's theory, it ought to have been. As far as this experiment goes, therefore, it is opposed to the new hypothesis;

although we admit, at the same time, that it is far from being conclusive. A female may, now and then, from accident, fail to secure the attentions of a suitable mate; yet from the polygamous propensities Mr Stoddart ascribes to the males, and the extraordinary superabundance of that sex among parr, this must necessarily happen on very rare occasions.

Although the opinions promulgated in this work, and in some others previously published, regarding the propagation of salmon and other fresh-water fish, run counter to long-established notions, to probability, and, to a certain extent, to knowledge founded on experiment; yet the subject is by no means foreclosed, but fairly open to investigation. So much obscurity hangs over the subject, not only from its own mysterious nature, but from the element in which these animals live, and their peculiar habits, which render accurate observation always difficult, and in many cases impossible, that it would not be very surprising if some fundamental error regarding their reproductive economy were found to exist. This point can be settled only by further observation and experiment, which we hope will ere long be supplied.

The "Angler's Companion" touches on all the points in which that amiable fraternity are in any way interested. The author is copious on the subject of the varieties of the common trout; and it is not a little singular that these should be so numerous, and often produced, as it would appear, by causes which we cannot appreciate. In Scotland, almost every lake, river, and streamlet possesses a breed peculiar, in outward appearance, to itself. This is not so very surprising as far as it concerns the colour; for it is obvious that trout, chameleon-like, assume the hue of the objects by which they are surrounded. Placed in a dark-coloured jar, as was done by Mr Shaw, an ordinary parr became nearly of the same hue as the vessel; another specimen, in a whitish vessel, changed nearly to the colour of the surrounding surfaces. But they also exhibit endless variety in other respects, in proportion of parts, colour and quality of flesh,* strength, liveliness, &c. The difference of food is probably the chief agent in producing these changes; but they often occur in situations where, to all appearance, the nutriment must be nearly alike. The red spots are more permanent, and vary little in the same breed, as to position, although they may in their size.

Salmon-roe is well known to be one of the most attractive baits in certain states of the water, and Mr Stoddart's chapter on the best modes of curing and employing it is extremely instructive and interesting. It is not easy to account for the attractive property of this substance. It is obviously most palatable, to trout more especially; but it is not easy to say by what sense or instinct they are attracted

* Mr Stoddart supposes that the Salmonidæ are the only fishes in existence in which the flesh exhibits a pink or reddish hue. This is not the case; the flesh of the Tunny is also red, and when cooked is not unlike a beefsteak.

towards it from a distance, and that, too, when the water is so dark and muddy, that the sense of sight cannot be supposed to be available for the purpose. It is more than probable that it emits some peculiar odour, or has some other penetrating and diffusive property, intended, in the breeding season, to attract the notice of the males. A property of this kind exists, in a very remarkable degree, among insects. A female moth, when in season, will bring males from all directions, often from a great distance, and from places where no ordinary search would have found them, and where they would not be supposed to exist. It is difficult to conceive that any scent could be so widely diffused, and that from so small an object, as to give the requisite intimation in this case; and it is not impossible, that some sense or instinct may be exerted to which we possess nothing analogous, and of which, therefore, we can form no correct idea. Something of this nature may operate in drawing fishes to the roe; for there seems no reason to doubt that they often come from a considerable distance, when the eye cannot be supposed to give them any assistance, and when an ordinary smell could not be supposed to penetrate so far through such a dense medium as water. The avidity of the common trout for salmon-roe, shows how destructive it must be to the deposits of ova in the spawning season.

It is solely upon this last-mentioned ground, says Mr Stoddart, that I take my stand, when palliating the use of the salmon-roe as an angling-bait, in certain rivers and seasons. I am of opinion, that in large waters frequented by salmon for the purpose of spawning, and also in their tributaries, the moderate employment of it in a salted state, acts powerfully in diverting the attention of more than one species of prowler from the natural ova or deposit, a very large proportion of which is every year consumed, as well upon the redd of the fish itself, as when carried down below it; moreover, I can conceive it to be great benefit to the breeding and increase of the *salar* or salmon proper, were it made allowable, by an amendment introduced into the various acts of parliament regarding our Scottish salmon fishings, to capture by means of this bait, during the close season, that species of fish which is well known under the designation of bull-trout. There is not, I am convinced, among the finny tribe, an enemy to the ova and incipient spawn of salmon more rapacious and destructive than this very fish; nor is it one, as is well known, remunerative as a marketable article to the tacksman or proprietor of fishings. It is seldom taken from our rivers in good and edible condition, ascending them in large quantities only during close-time: and at the commencement of the open season, continuing to haunt them, in the shape of a hungry and good-for-nothing kelt; thus, not only tampering with, and preying upon the undercloped deposit, but committing unmeasured havoc among the infant fry.—p. 159.

Our space will not permit us to mention the author's exploits by loch and stream, nor to show how effective the precepts he expounds prove to be when carried into actual practice. We love to fancy an angler superior to the ordinary wants of nature; and few of them there are, we feel assured, when they have fixed their barb in some goodly fish, which awakes the welcome music of the reel, and are straining every nerve, as it dashes through the stream, and

Shows to the sun its waved coat dropp't with gold,

to land it safe upon the pebbly shore: few, in such circumstances, will think of the appearance their prize will make—in the kettle. Yet our author, instinct as he is with the true feeling of an angler, bids adieu to his readers, by appealing to their appetites, and leaves their palate tingling with the vision of a salmon cutlet. "Angler! that all day long hast wandered by sunny stream, and, heart and hand, plied the meditative art—who hast filled thy pannier brimful of star-sided trout, and with aching arms, and weary back, and faint wavering step, crossed the threshold of some cottage inn—a smiling rural retreat that starts up when thy wishes are waning into despondency, how grateful to thee is the merry song of the frying-pan, strewn over with the daintiest of thy spoils, and superintended by a laughter-loving hostess and her blooming image! And thou, too, slayer of salmon! more matured and fastidious, what sound, when thy reel is at rest, like the bubbling and frothing of the fish-kettle; what fare more acceptable than the shoulder-cut, snowed over with curd of a gallant sixteen-pounder; and where, in the wide world, is to be found wholesomer and heartier sauce, to the one as well as to the other, than a goblet generously mixed of Islay, and piping hot? Stretch thy hand over thy mercies, and be thankful."

Practical Researches on Bones as Fertilisers. By MATTHEW M. MILBURN, Land Agent, Sowerby, Thirsk. There appears to be something in the use of bones, as fertilisers, which the chemical research of several years has almost failed to elucidate. Practice seems to have, to a certain extent, defied the powers of analysis, and we are often struck with the results of their application being different, and even contrary, to what might reasonably be expected. The application of bones to peaty sands, and light soils generally, created a new era in farming; and gave to loose sands, to chalks, and to peaty soils, a power of production which no previously discovered application could accomplish. The smallness of the quantity required, the facility of their carriage, and their ready application, doubtless gave great facilities to the growth of green crops on such soils, and on high elevations; and a stimulus was given to the discovery of light and artificial manures which previously [illegible] on which to proceed. The composition of bones [illegible] easily arrived at; and it [illegible] manifest [illegible] application of three to four [illegible] regards a turnip crop, produce [illegible] 00 cwt. of ordinary farm- [illegible] application of that small quan- [illegible] produced a crop weighing from twenty to forty [illegible] and what was more remarkable, an increase in the [illegible] he manure did not produce any appreciable increase

of crop. The chemical constituents of bones are well ascertained. Beyond organic matter, in which they may be said to vary from 20 to 30 per cent, they contain some per-centage of phosphate of lime, varying from 55 to 64, and of carbonate of lime, say from 15 to 16 per cent; not to mention the small per-centages of sulphuric acid and magnesia, which, in the quantities usually applied to an acre, may be considered scarcely worth naming. Assuming the composition of bones, such as they are usually obtained, to contain 60 per cent of phosphate of lime, it must be clear, that if four cwt. be applied to the acre, there will be applied something like three cwt. of phosphate of lime to the acre. We ought to remember, however, that one application of farm-yard manure restores much phosphate to the soil. The quantity, of course, varies with the quantity of excrement and urine contained in the manure; but assuming it to be merely decomposed wheat straw, and that the wheat straw contained, according to Sprengel, 340 lbs. of phosphate of lime in every 100,000 lbs.; and that three tons of straw are required to make one ton of manure, it follows that 20 tons of such manure will contain 3 cwt. of phosphate of lime. But if 10 tons only were applied to the acre, there would be but 18 cwt. 56 lbs. of phosphate of lime supplied, or only half as much as by a dressing of bones. Another difficulty arising from the supposition that the phosphates were the manurial excellency of bones is, that of all crops they appear to be most useful to the turnip plant; whereas that plant requires a smaller proportion of phosphate than most other cultivated plants. Still the difficulty occurs, that burnt bones are, in some instances, as successful as those which are undeprived of their animal matter; but this, again, is counteracted, in some degree, by the fact that dissolved bones, or more properly vitriolised bones, when the whole substance is broken down and rendered soluble, are the best of all the forms of applying bones.

The main success of applying them is in producing green crops, and thus obtaining manure from the keeping of stock. We have, however, had instances where the whole of the turnips were taken off by the wire-worm before we planted the land with potatoes, and not a vestige of the turnips remained, except possibly the small portions decayed after the insect had destroyed them; whereas the barley crop was greater than we could have expected after any crop of turnips we ever had in the field previously. An instance occurred adjoining our own farm, which goes very far to show the great advantage of supplying bones, and bones alone, to a soil for a number of years, with decided success. The quantity never exceeded sixteen bushels the imperial acre, and yet for sixteen years it grew sucessful crops.

To begin with, the soil was blowing sand, very poor and ex-

hausted,—the whole weight of bones did not exceed 16 cwt. in the whole period, and no other manure whatever was applied; and yet, on land not worth more than 20s. per acre to rent, four crops of turnips, eight crops of corn, and four crops of clover were obtained, being a weight certainly over, and not under, 100 tons; and the soil was, after the last of these crops, more capable of growing any crop whatever than it was before any bones were applied. Whenever the field was ploughed and pulverised, it had a semi-white appearance from the quantities of undecomposed bones on its surface,—a proof that of the quantity applied but a small portion had been consumed by the plants.

In order that the efficacy of these whole bones might be tested, we had a few handfuls picked up, which was soon done, and they were sown in a drill against some bones quite fresh from the mill. The whole came up and grew with equal rapidity, and we were unable to discover any difference in the plants; and, indeed, at the time when they were removed, we could not distinguish any advantage in either. Now, as these bones had been in the earth at least four years, and might have been much more, it appeared as if the decomposing action of the air and soil, and of the vital action of the plants, was very slow; and, therefore, that the quantity required for each crop of the ingredients of the bones is comparatively small. It appears that bones, near the surface of the earth, lose mainly their organic matter, and the decomposition in such a situation liberates the gases; whereas, when buried deep, no such process takes place, inasmuch as the oxygen is excluded, and that, if buried deep, they lose their organic matter slowly; and probably more of the phosphates are carried down by the water than animal matter liberated by the air; so that bones which may be buried deep will be less injured than might be imagined.

The fact that so small a portion of the bone is required, is proved best by the effects of the acids on the bones, rendering them soluble, and thus reducing the quantity of bones by something like 75 per cent. This has been considered satisfactory evidence that the phosphates are the only source of the value of bones; but it is a somewhat hasty conclusion, for the organic matter is also rendered in a state more capable of decomposition than before by the application of the acid. Nor must the action of the acids themselves on the soil, and [illegible] vegetable matter contained in it, with which they [illegible] lost sight of. It is almost impossible that some [illegible] the acid should [illegible] free,—or, if not, the new combinations of [illegible] is composed will alter many of the [illegible] matter for which it may have a greater [illegible] alter these proportions. It is common to [illegible] with sulphuric acid alone; and [illegible] the sulphates may [illegible]

valuable character, not to mention its effects in the general disintegration of the mineral matters composing the soil.

On the continent of Europe, diluted sulphuric acid is sprinkled upon the soil during the season of fallow, by means of the usual apparatus for distributing liquid manure, and is said to be attended with decided success. We have not heard of any instance of the acid being applied alone in this country,—it is generally administered in the vehicle of bones.

The lime in the soil would, if free acid were applied, become sulphate, as far as excess of acid were prevalent; the ammonia in carbonate and volatile would become fixed as sulphate; and the same changes would follow in many other particulars, and the plants and animals which feed on them supplied with the sulphur which they contain.

We applied to the soil, in a field of gray sand, subsoil yellow sand—bones in the raw and dissolved state,—the former at the rate of 16 bushels per acre—the latter at the rate of four; and, along with this, we sowed about four bushels of dissolved animal matter in the same way. The bones dissolved in acid had the preference from the first, and a great struggle seemed to exist between the dissolved animal matter and the raw bones. We weighed a number of yards in each, and the result was:—

	Stones.
No. 1. Sixteen bushels of raw bones, ...	52.
No. 2. Four bushels dissolved animal matter, . .	50.
No. 3. Four bushels of dissolved bones, . . .	60.

Thus we inferred that the bone dissolved was preferable to the muscle and fat. Still, if the water of the former had been more thoroughly extracted, it is possible that the results might have been somewhat different.

The great efficacy of the dissolved bones seems partly to consist in pushing away the plants in their early stages; and so vigorous are they generally found, that they defy the attacks of insects, and even of seasons which are fatal to plants not manured with so powerful a fertiliser. The turnip plant derives much of its nutrition from water and from the air; and therefore any substance which will enable an abundant and early development of plant, will be of the greatest service, generally, to the crop. This will give very much, perhaps, the idea that the bones act as a stimulant rather than a real fertiliser; and perhaps there is some difficulty in drawing a very clear line of demarcation between a stimulant and a nutritive manure. A mere mineral manure would stimulate a soil very rich in ammoniacal and vegetable matter; but continue the process, and the addition of such manures would in time cause the plants to take up the excess of the latter, and the former would produce no effect; while, on the contrary, the soil, if abundant in mineral matter,

would be stimulated by ammoniacal and carbonaceous manures as long as the mineral matter were in excess. A manure, however rich in both mineral and ammoniacal matter, would in no sense of the word be a stimulant, but strictly a "a feeder" of the soil. This, to a certain extent, is bones. The animal matter contains the gases—the mineral matter contains phosphorus, lime, magnesia, soda, potash, and possibly sulphur; so that in no sense of the word whatever can bones be considered a mere stimulant.

What, then, is it to which their manurial power may be attributed? This seems puzzling; but inasmuch as they contain organic matter, they are calculated to supply the deficiencies of soils destitute of it; and as they also contain mineral matter, they also supply these to soils from which they are exhausted; while to such soils as contain both in equal degrees, they add to the stock in the soil, and render it more capable of growing any of the cultivated crops.

Doubtless, however, the great value of bones is in their supplying food for green crops. These properly and judiciously applied cannot fail to enrich the soil; and thus the bones become absolute manure-makers on a farm, and lay the foundation of future crops in a manner which it is not easy to do in any other way.

From the facts above stated, it would appear that bones must be an excellent manure for any soil. But facts have been opposed to this theory. The privation of phosphoric acid in the wheat and beans and oats sold off every farm, and in the bones and flesh of the animals grown upon it, seems to apply very forcibly to strong land farms; and therefore, it would appear, bones would be a valuable restorative of this abstraction. The contrary is the fact; on clay the bones have, in almost every case, been nearly thrown away.

Practice solves the difficulty. We have seen that the bone decomposes slowly—that it gives off but a little of its principles at a time; and inasmuch as a clay soil is unfavourable to fermentation and decomposition, the valuable components of the bones are not given off, and therefore they are of little service; but it is worth while to try whether dissolved bones will not on such soils be what raw bones are to land which is dry and light.

The soils most benefited by bones are *gray sand* with a sandy subsoil. This, before bones were introduced, was very difficult to obtain turnips upon, and it was the most useless of all soils. Now it is rapidly treading the steps of the most profitable. *Gravel* is next benefited by their application, but less so than sand, and in dry seasons, when all other manures will often fail, these will secure an abundan[illegible] *white, and yellow sand* are all [illegible] application of bones and to all such soils [illegible] application. *Pe[illegible]* soils are specially [illegible] these obtained

upon them which are obtainable from no other source. *Chalk* soils are amongst those on which the greatest improvement has been made. Elevations out of the reach of any more bulky and solid manure are rendered at once by bones within the means of amelioration and productiveness. Most manures may be advantageously combined with them. Farm-yard manure is always a valuable auxiliary, and may be mixed or combined with them with safety in almost every conceivable way. With guano—with nitrates, with rape-dust, or any of the artificial manures generally applied, they may be used in combination without danger or fear; but with lime they have often failed, except when the soil possesses a very large share of inert vegetable matter. This neutralises the lime, and renders its application in no way injurious to the bones. It is desirable, however, to apply the lime at a period as far removed from that of the bones as possible. On the whole we may be considered within the mark, when we say, that the introduction of bones as a manure has been a boon of millions of wealth in the shape of increased production to our population.

Landscape Gardening, a Reasonable Art. By MR DAVID GORRIE, Annat Cottage, Errol. The word *reasonable* is now-a-days generally applied to something that is tolerable, or not immoderate, but is here used in its good old-fashioned sense; and indicates that landscape gardening is a rational art,—an art that is, or ought to be, conducted agreeably to the dictates of reason.*

If any object be more beautiful than another, there lies somewhere a plain and palpable reason for its being so. Thus, a square is more beautiful than an equilateral triangle, because, with equal uniformity, it possesses a larger share of variety. For the same reason, a hexagon is more beautiful than a square; a cube than a pyramid; and a solid figure hexagonal on the sides, than a cube. An irregular triangle is less beautiful than an equilateral one, because, though possessing equal variety, it lacks uniformity. These two principles, variety and uniformity, when found existing together, lie at the foundation of beauty in the form of natural and artificial objects, and their position in respect one to another. How much uniformity is there in the works of nature, and yet what an endless variety! In celestial scenery, one law of motion,—one shape and form,—one nature, pervades the heavenly bodies, and yet no two of them are alike, "One star differeth from another star in glory." In the vegetable kingdom there is a sameness in shape amongst the leaves and flowers that grow

* The word is used in a similar sense by the translators of the English Bible in Romans, xii. 1.

on a particular plant or species of plant, and a regularity in their arrangement around their axis, to such an extent as to show an intimate relation between the parts of a plant from the meanest to the most worthy, and to give some countenance to the first principles of the science called vegetable morphology; and yet variety is manifest in the minutest parts,—in the stripes of the flower, the eye-lash like hairs of its calyx, the veins and serratures of the leaf, and the cells and spiral vessels of the stem. In the inanimate creation there is variety combined with uniformity in the strange forms that constitute a snow-flake, in crystals of salt, and in the minute atoms that unitedly constitute the towering precipices. The two principles require to be combined both in architecture and landscape-gardening; and when so combined, they raise these pursuits to the rank of reasonable arts.

Variety has a certain degree of beauty that belongs independently to itself, and uniformity has the same; but when disjoined, each of these kinds of beauty is of an imperfect kind. There is beauty sufficient in the regular array of spots on a child's dress to please its owner, but not to satisfy a rational admirer of beauty. On the other hand, a piece of park scenery may possess abundance of variety, and yet be condemned as a work of art, because, from being ill-arranged, ill-laid out, and ill-planted, it lacks order, harmony, and uniformity.

Many persons suppose that landscape-gardening, instead of being an art dependent on fixed principles, is merely a thing of fashion, taste, or caprice. It is certainly an art of taste, but, primarily, not of fancy—a word wherewith taste is often confounded, as if the two were exactly synonymous. Landscape gardeners themselves have, it must be confessed, conferred too much probability on this false notion by refraining from acting on fixed rules. Improved plans of places have been too often got up by them in accordance with fashion; and it is well known that, in the rage that existed in favour of the modern or natural style of gardening in the past century, plans were prepared by the dozen, by professors of the art, for places that they had never seen, and of which they knew little besides the measurement and general exposure. In these plans uniformity existed in full measure;—the same surrounding belt, the same serpentine approach, the same bare lawn surrounding the house,—and all because it was the fashion. Ancient and stately avenues were destroyed, and the reason given was just "I hate an avenue." Terraces were removed, because terraces had become unfashionable. Sweeping lines were formed, because,—but why say *because*, when no other reason could be given than that embodied in the words, "I love [illegible]," or, "straight lines are out of fashion." Thus it [illegible] that landscape-gardening in many parts of the country ceased [illegible] ...ence, and that its practice ceased to be

thought of as an art of reason. In the history and progress of landscape-gardening, as in those of architecture, fashion and false taste have ever been brakes on the propelling wheel. The removal of these hindrances has been often attempted, with greater or less success, by various rational professors of the art, at whose head, in modern times, must be placed one of the most amiable and talented of departed Scotsmen, the late Mr Loudon. Where-ever his writings penetrate, caprice and fashion must hide their heads before the vigorous embodiment of a true and rational taste which they exhibit.

The word taste, when used in reference to the feelings excited on the contemplation of objects of natural or artificial beauty, ought to be considered as implying intellectual relish or discernment, and should not be confounded with the term fancy, which has been defined to be an opinion bred rather by the imagination than the reason. Were taste confined to its own proper signification, it might be easy to prove that its pleasures are dependent on fixed principles; that as sugar is sweet and vinegar unpleasant, in the estimation of every person whose taste for articles of food or drink has not been depraved by custom, so there are certain lines and forms, and certain dispositions and arrangements of visible objects, which must afford delight to all whose mental discernment of beauty is natural and unstrained,—whose intellectual taste has not become depraved through fashion, caprice, or false associations. By studying carefully these particular lines and forms,—these peculiar dispositions and modes of arrangement,—the landscape-gardener becomes able to act on rational principles in the exercise of his profession. In forming sheets of water, he can blend intimately the works of art with those of nature; in planting masses of trees, he can avoid formality, and ensure endless variety, together with a pleasing combination of parts and continuity of outline; in tracing out a sweeping line of walk or approach, he can introduce manifest reasons for not going straight forward; and in laying down a flower-bed, he can so perfectly form and so rightly place it as to render it impossible to alter it in shape, size, or position, without marring its beauty. A want of the knowledge derived from such study renders the landscape improver a slave to fashion or caprice—a ready imitator of any thing he may have seen others do, however absurd and incongruous it may appear to the eye of reason to be in the particular case.

There have been instances of grounds laid out according to the dictates of capricious feelings, and which, nevertheless, it would not be commendable to alter or attempt to improve. The park of Alton Towers, as adorned at a vast expense by Charles the sixteenth Earl of Shrewsbury, and as described in Loudon's Encyclopedia of Gardening, forms an apposite illustration of this truth. The wealthy Earl, acting entirely as an architect and scenic im-

prover of caprice, consulted various eminent artists, and in practice exactly inverted their advice; so that he produced scenery of such an incongruous character as to differ from any thing of the kind that had ever before existed. The mansion-house, we are told, was an immense pile of building, with a magnificent conservatory and chapel, but with scarcely a habitable room. A lofty prospect-tower was built in a low and secluded part of the grounds. Expensive bridges were constructed where there was no water to cross. Ponds and lakes were formed on the summits of hills; and to the surprise of strangers, were supplied with water from cascades, although the point from whence these cascades fell was higher than any other ground in the vicinity. A valley, naturally romantic with wood, water, and rocks, was filled with works of the highest degree of art in architecture and gardening. In expending his money in the embellishment of this enchanted valley, and in the construction of the various works of art intended to improve and adorn the grounds of Alton Towers, the Earl acted avowedly from caprice. He did not pretend to act rationally, and might have been displeased had such an intent been imputed to him; and, therefore, any strictures that may justly be made against irrational landscape scenery of the ordinary class, do not apply to the strange and wilfully capricious scenery of Alton Towers. Had he professed to be guided by true taste, the critic's words of condemnation could not have been made too strong. As it was, he deserved nothing but praise; for he was completely successful in obtaining his professed object. Only, his example would have been dangerous, yea, impossible to imitate. It is not by slavishly imitating the eccentricities of genius,—by refraining from wearing a neckcloth because Byron did so, or by using uncouth and homely expressions in oratory because such expressions were used by Chalmers,—that a person can attain to the character of being talented; neither can the imitation of falsehood in taste ever place the imitator in the position of the person by whom he professes to be guided. Nothing will bear imitation save truth; and the scenery of Alton Towers was perfect and unimproveable, merely because it exhibited the perfection of falsehood in taste.

It is hoped that the reader of these remarks, however incomplete they may be, has been convinced, if conviction was necessary, that landscape gardening, when it takes its place among the arts and sciences, is something that is based on the principles of truth, and guided by the dictates of reason. Were this not the case, it [illegible] deserve the name of either an art or a science; and [illegible] be classed, as it has too often been, among things of [illegible] fancy. It remains only to guard against an impression which [illegible] the above remarks may be ready to produce, to the [illegible] scientific improver of landscape scenery must [illegible] mechanical rules in the exercise

of his profession. This were as bad as to be a slave to caprice. By acting unconditionally and slavishly according to the most approved rules, an improver may produce a scene utterly wanting in congruity; for this reason, that he has allowed rules to become his masters, instead of keeping them in their natural place of servants. Fixed rules cannot apply with the same force in every case; and however good they may inherently be, they must always be kept in subordination to the intellectual feelings of the artist. It is here that imagination may be allowed to come in: first, reason, and then fancy. Having laid the foundation on truth, the imagination may be allowed to garnish the superstructure; always, however, in consistence with true principles. While expatiating on truth, the imagination is exercising its legitimate object, and it is only when they lead into the mazes of error that its pleasures ought to be avoided. In the art of improving as in that of painting landscapes, the fixed rules of truth are skeletons, which the imagination must be allowed to clothe.

Two paintings, by different masters, may each have been finished in exact accordance with the rules of the limner's art as respects the due proportions of light and shade, and other primary considerations; and yet there may be a vast difference in their comparative effect. In the one there may be a slavish imitation of forms and colours, arranged, no doubt, in agreement with strict and proper rules, but there may be nothing to divert the beholder from the idea that he is gazing on a plain piece of canvass. In the other, the hand of genius may have been employed; and the enchanted spectator may imagine that he hears the silvery air that creeps through the long grass, or the moaning wind that sweeps around the ivy-clad ruin. He may see, as in reality, a "beautiful vision of the grassy hills, bathed in the brightness of the summer sun," or think that he hears "the bittern's sounding drum, booming from the sedgy shallow." The fair face of heaven, calm and serene; the sky rolling on in its beauty — or the lurid glare of the lightning; the rolling and foaming of the restless sea, black with impending destruction; the falling of the proud oak, riven by a thunderbolt, and shorn of its leafy honours by the red artillery of heaven;—all may be portrayed, if the hand of genius grasped the pencil, with a truth that compels the beholder to stand still and gaze with silent awe, forgetful, almost, that there is nothing before him but coloured canvass, acted on by light from a few panes of glass.

Strict attention to rules, with nothing besides, will neither make a landscape-gardener nor a painter; and yet, rules, reasonable rules, are absolutely necessary for the guidance of both. The painter must not only attend to the instructions which he received in his youth from his drawing-master, but has also to embody his naturally acquired genius on the canvass; and his brother artist, in

handling, not the brush and palette, but the theodolite, compasses, and square, must bring into action his mental capacity for discerning between what is really beautiful and what is not. There is a poetry in both arts, and their respective professors must be fitted to receive the impressions produced by beauty and harmony into their own minds, ere they can succeed, by means of their works, in conveying similar pleasing impressions to the minds of others.

The use of rules, in both arts, is to act as guides in the designing and finishing of pleasing compositions, and to prevent that anomaly and incongruity in scenery, whether it be real or painted on canvass, which manifest a depraved, unnatural, or capricious taste. This false taste has been the occasion of many of the changes that have taken place in style — both scenic and architectural. There is not a style of building or of laying out grounds that may not have rational beauties of its own. There is beauty in the Egyptian obelisk, the Grecian temple, the Turkish mosque, and the Gothic cathedral. Objects of admiration may be found in the terraced gardens of Italy, the shaded grassy glades of France, the rigidly geometrical flower-beds of Holland, and the wide-spreading lawns of Britain. Each style may have faults; but each, in as far as it is fitted to circumstances, has its perfections also. An Italian garden could not be formed on the plains of Holland; nor could the straight canals of a Dutch garden be introduced amongst the varied scenery of an English park. And as the gardener, in planting a rose, does not intend thereby to detract from the beauty of the neighbouring lily, so it is not the landscape-gardener's business to attempt the depreciation of one style of laying out grounds, thereby thinking to raise another in public esteem. It is his concern to cull beauties wherever they are to be found, and to remember that no one manner, style, or sub-style of laying out grounds can ever become of universal application. Reason will teach him to adapt his style to the geological or other peculiarities of the place which he sets himself to improve; and in the carrying out of that style will prevent him from tracing a single line, or planting a single tree, without an evident cause for the nature of the one and the position of the other.

Characteristics of the Seasons of 1847. By Mr TOWERS.—The last article bearing this title brought the report up to the third week of November 1846, when I think we may fairly date the commencement [illegible] the agricultural winter. Our astronomers, no doubt, are [illegible] their divisions of the year into four quarters, governed [illegible] apparent course of the sun in his passage through the [illegible] signs. But the agriculturist must be guided by observa[illegible] experience; and these instruct him that the cessation of [illegible] the season of torpor, are fully established by the 21st, [illegible] 5th of November, which latter date would

give six weeks of winter in the current year, and an equal period of time in the year succeeding.

Without further preface, I shall at once come to the consideration of a series of seasons, which at all events were productive of extraordinary phenomena.

Commencing with NOVEMBER 16, 1846, I find by meteorological tables that we first experienced an entire change of wind from the east, wherein it had been fixed during eleven days with very little sun, but much gloom and haze. Sowing of wheat proceeded, having been resumed about the 25th of October, or so soon as the land had become open after the profuse rains of October, which had for a time utterly prevented that important operation. The southerly winds now brought rain again, and that continued till the 25th inclusive, with some haze on the last two days. On the 27th the barometer stood at 29 inches 30 cents; the morning came in with frost, wind north-westerly. Winter was then effectually established, the atmosphere bright and sunny; on the 30th morning we had 9° of frost (23° F.)

DECEMBER was severe throughout: in it the wind blew from some easterly point for sixteen days; of the other fifteen, there were only five or six wherein it partook of the milder character, the wind generally coming from some southern point. The greatest degree of cold occurred in the mornings of the 11th, = (26° Fah.) also on the 13th (24° F.) 15th (19° F.) and 28th (18° F.) The average minimum of all the nights, 28°7; maximum of all the days, 36°4. Rain fell slightly on seven occasions; snow twice on the 29th and 30th, when the barometer was at its utmost elevation, 30 inches plus, 47 and 50 cents; wind south-east.

1847. JANUARY came in with frost of mild character, (28° F.) which continued three days, with a little snow. Clouds, haze, and dense fog, succeeded; there was also a little rain, the temperature being mild till the 9th. The air then became more frosty till the 21st day. The barometer was high, above 30 inches; three days were clear and sunny, but haze and clouds predominated. The wind changed to west and south-west, and a little snow fell on the 20th and 21st. The 22d day became mild, and the weather was open, with westerly breezes till the 29th, whence, to the close of the month, we had night-frosts. On the whole, January was not severe, the average of all the days being, by my table, 38° 6′, and that of all the nights, 32° 6′; that is, $\frac{6}{10}$ths of a degree above the freezing-point.

The *wheat* made scarcely any visible advance during the month, for it had received a thorough check by the frost of five previous weeks; hence the fields displayed very little verdure: of all other herbage no opinion could be formed. Provisions continued to rise; the poor began to feel a privation of their favourite food, bacon; and as to potatoes, they became very dear, (5s. or 6s. per bushel,)

the crop having been reduced as much by the aridity of the summer as by the ravages of disease, which latter had, indeed, lost much of its severity,—at least in our southern counties.

FEBRUARY came in cloudy;—a steadfast gloom from the north, with 3 degrees of frost. This month may be quoted for its repeated alternations. The 4th was beautifully fine; 5th and 6th mild; then followed seven days of very keen frost, by night, after the *only snow* of any consequence which we had in East Berkshire. This snow fell chiefly on the 7th and 8th; the night became clear, with 27° of Fahrenheit. The following figures indicate the degree of *actual frost*, by night, till the 15th, when a change of wind, from north-west to west, occurred;—8th, 12°,—9th, 11°,—10th, 8°,—11th, 3°,—12th, 20°,—13th, 14°,—14th, 6°. The sun shone powerfully from the 9th to the 13th, and gradually removed much of the snow, by evaporation, for little of it was dissolved upon the ground.

Here, as a precaution, it should be observed that, in the event of heavy snows, evergreen shrubs which are covered with it should be well shaken by long slender poles, or whisks, before the sun break out with power, otherwise the leaves may be seriously scalded, an injury which often terminates in the disfigurement, if not total ruin of the plants.

Rain came immediately after the change of wind: it carried off the snow in two days. The 15th, 16th, 17th, and 18th were rather wet, with occasional gusty wind: two days were fine during the mild interval of eight days, which terminated with the 22d, when the wind veered suddenly (at the moon's first quarter) to east, then to north-east, and brought a return of frost to the extent of 3° and 4°. The barometer mounted to the average of 30 in. 20 cts., and maintained this elevation till the close of the month. The mean temperature of all the days and nights was—min. 32° 2′, max. 41°. *Rain* with snow, only 0·94 hundredths of an inch.

MARCH.—As the barometer had ranged above 30 inches from the 19th of February to the end of that month, so, with the exception of an hour or two on the 7th and 10th inst., it continued equally high till the 15th inclusive. This is the first striking phenomenon I shall notice. My instrument, it is true, is inclined to give a higher mark than do many others of equal value; but the excess is not more than a few hundredths of an inch; yet when I say that on the 2d, 3d, and 4th days its register gave 30 in. 48 cts.—30 in. 49 cts., other glasses did not, perhaps, mark above 30.39 and 30.40. With the admitted high degree of atmospheric pressure, with the wind [illegible] [illegible]h-east, north, veering to north-west [illegible] [illegible] the absolute exclusion of a sun-beam [illegible] then the sun broke forth; and from that [illegible] excepting the 21st and 28th, be-[illegible] the mornings o[illegible] 23[illegible] and 27th [illegible]

Now, it is remarkable that so long as the wind remained northerly the sky was overcast. But when, on the 14th, it veered by the north-west to south-west on the 15th, and thence continued to fluctuate between that point, south-east, and north-west—the barometer receding to 29 in. 50 cts., at an average about 29 in. 70 cts.—the heavens assumed a contrary and clear aspect! Rain to no extent fell on six or seven days, remote from each other: snow three times, but merely in slight passing scuds from driving clouds. On the whole, the ground was scarcely moistened.

The period of the *vernal equinox* now approached: the precise day was March 20, 17 h. 28 min. astronomical time, corresponding to 21st—5 h. 28 min. of the morning; the sun then entering the spring sign γ or the Ram. But, prior to this season, a phenomenon of great beauty occurred, of which I shall endeavour to revive the recollection. On the 19th, at 9 o'clock P.M., a grand arch passed from the western horizon, near to the star Aldebaran in the Bull's eye, then over Gemine, by the bright stars Castor and Pollux, and so on direct east, close to Arcturus in Bootes. This arch, or "*Trabs electrica*," (as by some philosophers had in 1826 been stated,) was therefore high in the heavens; it was rather wavy and ill defined at the edges during fully 10 minutes of duration, but gradually became rather narrower; and finally, almost correctly true in its form, which was that of a narrow belt, resembling the milky-way in colour. It gradually disappeared, and was no longer visible before 10 o'clock; but, just at that time, a blaze of true yellow *aurora borealis* broke forth, low in the magnetic north, and continued for a minute or two. These were the appearances observed by me in Berkshire: elsewhere, according to public reports, the *aurora* was beautifully and variously coloured. Be this as it may, as the two phenomena were displayed at right angles with each other, we have, I think, a right to conjecture that they thus afforded a visible display of *electric* and *magnetic* light. When, in former years, these beams were seen, it was in the autumn, and we inferred that they were the precursors of the abundant rain which immediately followed. In the instance just noticed—that is, when the beam was seen, about 32 hours before the spring equinox of this year—the weather remained open till the 27th, with some sprinklings only. On the 28th, the wind went to the northward again, frost returned, and the month terminated beautifully fine, with 4° of frost on the 31st. The averages of temperature were with me, min. 36° max. 48°.

Recurring to the *equinox*, I have been in the habit of viewing it as a prognostic of the weather; and, after the experience of 27 years, — though my confidence has been somewhat disturbed—I must say that the subject is still worthy of extended observation. The late Gilbert White's meteorological tables (see History of Selborne) tend to confirm this opinion, as does likewise Kirwan's

equinoctial theory, the purport of which is, that "if the weather be fine, with no particular storm from the south, or south-west, within two or three days of the sun's entrance into the sign Aries or Libra, the following summer or winter will be fine, in four instances out of five." I quote from memory; and, in corroboration, observe that, in 20 instances out of 27, I have remarked that a fine and dry season has been preceded by a dry and northern equinox, and *vice versa!* But I have also observed that there have been prognostics of a character so ambiguous as to set at nought any reasonable conjecture. Thus it happened at the spring equinox of last year, 1847, as the following extract from my diary will show:—

March 20. Wind south, cloudy. 21. South by east, fine gentle air.—*This was the Equinox.* 22. Wind, north-east; very fine. 23. Wind went back to south-west, with fog and rain. 24. South-west to north-west; gentle air and fine sun. Thence to the end variable in every respect. Some showers, gentle air, with wind S.W. S.E., ever fluctuating. *No storm*, or even lively wind at any period of March, nothing beyond a slight breeze. Yet, what a glorious and maturing summer succeeded! We must, therefore, hesitate!

April was a cold ungenial month throughout: the barometer was generally low, yet the atmosphere remained unusually clear and sunny. The three first days were frosty; wind, a point or two from the west, generally by north, till the 13th; and during this period a few scuds of snow, and transitory showers occurred, but none that could be considered as *rain*, with the exception of the 10th, on which day, after a hazy morning, there fell a gentle shower, that lasted nine hours. In 1846, there were twenty days more or less rainy: the ground was saturated, and thus the land was enabled to support the intense heat and aridity of the two following months. The supply of rain during the whole of last April was too trifling to be appreciated, but, slight as it was, the showers fell opportunely. Average quantity, 0.92 cents. The 13th day introduced a total and winterly change. Wind blew from north-east during four days, and the air was frosty, and perfectly clear, with bright and hot sun at mid-day. Here I first began to notice the relative condition of the *oak* and *ash* trees.

The season, as I have said, was peculiarly cold and dry, insomuch that the corn remained nearly stationary; yet the buds of trees advanced, and among others those of the ash, which exhibited their black-tipped germs of young growth; they were so far developed as to be somewhat in advance of the *oak*. This was the more remarkable in a tree so tender in its foliage, and it therefore required minute attention. There is nothing of blind prognostic in the warning thus given by natural agents; we may not understand them; but, if Mr Sturgeon's theory be correct, and founded upon authentic data, the *ash* and the *oak* being in opposite states of electricity, each

in its turn, then it will follow that, when the former tree is negative, the latter will be positive; and if so, each may form an index which shall correctly pre-announce the character of the ensuing spring and summer. Assuming this to be the fact, when it was observed that the ash-tree buds, at the middle of April, were distinctly in advance of the *oaks*, we were induced to suspect the approaches of a wet and dripping season. At that time nothing could be fairly ascertained, so cold and parching was the atmosphere; but ere long a meteoric transition occurred, which will be noticed in its proper place.

After the 13th of April, and so long as the wind came from an easterly quarter—that is, to the 24th inclusive—we had a bright sky, with a night-average temperature of very nearly 34°, though three nights were decidedly frosty. Another change occurred on the 25th, when the south-west breezes raised the instrument to at least 43°, and at a maximum to 56°. The mean temperature of the month's extremes were 37° 86 cents, and 50° 5 cents. There was not one day which produced 60° at its highest elevation.

MAY was introduced with cold north-easterly weather, the character changeable; now and then showery, with biting wind, and a little hail. During the first nine nights, my thermometer ranged between 36° and 44°, once only rising to 48°. There seemed to be no end of the winter: it had then continued for nearly five months; there had been much warm sun, but no genial temperature. A change took place on the 6th, when the south wind became steady, and the noon temperature rose to 62°: the day was beautiful throughout; and now, just at the critical period, I began to observe more activity in *the buds of the oak*, while those of the *ash* appeared checked.

I shall never forget the morning of the 7th—the sun shining with gentle spring power; the grass covered by dew, which sparkled with prismatic brilliancy; the song of the lark, and of other soft-billed warblers, was perfectly joyous—in a word, this morning ushered in *the spring* of this extraordinary year! At that precise time, though there had been bright and sunny days, and nature had afforded evident proofs of preparation, yet the *cold*, and continually recurring frosts, had interfered to an extent which maintained torpor. The buds of trees and shrubs were enlarged, but could not expand; the grass of meadows became somewhat green, but could not grow; the wheats, however thickly sown, had a poor and dwindled appearance, and, in numberless instances, could with difficulty be traced in the drills; and clovers were excessively poor. We had occasion to journey, and by ten o'clock quitted the neighbourhood of Maidenhead, the sun, at that time, losing its rich brilliancy, and the atmosphere beginning to be streaked with grey cirrus clouds. The corn-fields throughout bore every where the same complexion; the wheat plant more backward than it often

is at Christmas: in a word, every thing afforded proof of the extreme protraction of the winter. However, before noon, rain-clouds formed, and a gentle, warm shower fell. It was accompanied by a lively south-western breeze, and genial temperature of 60°. On the 9th it rained again, and the mid-day heat inclined to 65°. Showers, alternating with sunny gleams, and advance of temperature, gave energy to vegetation, and the difference thus produced was beyond imagination. In one week the fine arable land between Croydon and Ashstead, beyond Epsom, was covered with rich and strong verdure, proving that apparent loss of time had, in truth, been thoroughly redeemed. In 1843, after one of the mildest seasons observed by me in Berkshire, the wheat and oats were magnificent, fully 12 inches high in the first week of April. On the 12th and 13th of that month much snow fell before sunrise. Severe night frosts followed, and intense solar power by day. The oats assumed a purplish marone tint; the wheat became buff-spotted and streaked; the foliage was paralysed, the ears subsequently emerged poor and weakly, barely an inch long; and finally, yielded not half their wonted average. A cold, dripping summer completed the degradation which untimely frosts had commenced. Thus we plainly perceive that, however backward a season may be, the healing and redeeming powers of nature (provided they be consistently maintained) are competent to bring all the fruits of the earth even to early perfection.

The heat by day gradually progressed between the 15th and the 22d from 65° to 69°; the night temperature was fully equal to 51° to 59°. The atmosphere was generally clear and far too dry for spring, the merest traces of rain falling on the 15th, 16th, 18th, and 20th. The wind varied but little, being sometimes nearly south. During this period the question of the *oak and ash trees* was entirely decided, by the advance of the former, so as effectually to distance that of the ash: hence the experience of five yearly observations led to the conclusion that in all probability the summer would be found dry and warm. On the 20th of May—wind electrical—E., S., S.W., with smoky haze; the early morning was oppressive. The heat from 64° increasing to 73°. Thunder in the east of Kent occurred, and a little rain fell, but not so in East Surrey. Heat continued great to the 29th, with fluctuating, cross currents, and thunder-storm came on the 29th. One result of this great and sudden heat was the extensive destruction of the apple, plum, and strawberry blossom, and the introduction of those myriads of *aphides* which made a most destructive onslaught upon currant-shrubs in the gardens, and deformed the oak and other forest trees. It is no less curious than true, that, whereas almost every species of vegetable production suffered, the potato escaped; not one "*vastator*" paid Mr Smee the compliment to verify his hypothesis! The average temperature of the days 64°, that of the nights 51°.13;

this depression was produced by that of the nine first nights of the month, which barely averaged 40°.

JUNE.—There were certain phenomena in this rosy month which rendered its meteorology very peculiar, and considerably affected some of the agricultural crops. In order to convey something approaching to a correct idea of these phenomena, I will divide the month into three distinct periods, and take particular notice of the condition of the crops thereby induced. The *first period* must commence with the 31st of May, and will extend to the 5th of June inclusive. It was dry, the atmosphere pellucid, and sun brilliant; the temperature decidedly warm, the maximum in the shade about 71°5, the minimum average of the coolest hours of night or early morning, about 56°. Vegetation progressed most rapidly. The wind from north-east was gentle and balmy, and the barometer remarkably high; but *that* it had been ever since the 20th of May, on an average several 100th parts above 30 inches. The *second* period was suddenly introduced by a change of wind to north-west; on the 6th the mid-day heat falling to 60°. It comprised 19 entire days, ten of which were more or less rainy, with clouds and gloom; six were sunny throughout, and five changeable, by reason of clouds and intermediate gleams, but all cold and ungenial. The morning of the 7th gave symptoms of a slight hoar-frost upon some herbage, which affected the summits of a few potatoes, and raised the alarm-cry of disease. I investigated some large plots, and proved that the partial yellowness and flaccidity of the upper leaves had nothing to do with the late malady; and so the farmer discovered to his great satisfaction, when he sold five or six acres for £24 per acre. It was somewhat remarkable that, during this cold and gloomy weather, the prevailing wind was south-westerly. On the 26th a change took place: the current became northerly, the temperature rose to 70° and 72°, and the month closed beautifully; but time had been lost—the crops were retarded, and the ground again became arid—a condition which much reduced the bulk of hay-grass, and greatly injured the beans, that now began to fail under the destructive power of the black *aphis* or *dolphin*.

I am aware that much rain fell partially in the north and west; but in Surrey, and to the east and south of it, the showers scarcely penetrated through three inches of the surface. The average temperature of June was, at the minimum, 54°, at the maximum only 64° 4 cents.

JULY proved one of the dryest months of the year; it was sunny throughout its general course, and in our locality claimed the following remarks, which I appended to the monthly diary. "The rain here has been nothing, though more abundant in the west." As a natural consequence, the swede crop became very shabby, promising no results at all; while the sowing of white turnips appeared to be an impossibility. Some few fields were seeded,

broadcast as usual, but to very little purpose. On the contrary, the turnip cabbage *(Kohl rabi)* went on triumphantly, retaining its verdure, and proceeding onward to the bulbing stage without let or hindrance. With facts so conclusive, without a single exception on the high tilled lands, I cannot close my eyes to the great importance of this vegetable. True it is, that had but three wet days occurred, so as to soak the land, the advances would have been more rapid; yet there was not one instance of failure, or serious flagging, either in the seed rows or among the plants finally set out. Further notice will be taken of the results as the appropriate seasons come round.

The temperature of the twelfth day was moderately warm, rarely arriving at 76°, or summer heat. The eighth day proved rather showery. On the 12th that extraordinary rise took place, which must be registered as characteristic.

		Deg.		Deg.		In.	Cents.
	Maximum,	81	night medium,	69	barometer,	30	26
13th	.	82	...	69	...	30	30
14th	...	85	...	71	...	30	28·5
15th	...	82	...	70½	...	30	20
16th	..	81	...	70½	...	30	11·5

The wind was at first south-westerly. On the 14th it fluctuated, and on the 15th and 16th blew from north-east. Nature was absolutely oppressed; the evenings being hazy and close. A thunderstorm, with a lower eastern current, occurred on the 17th, with some rain, and a great reduction of heat. The barometer was read off far above 30 inches from the 25th of June to the 19th of July: though on two days the mercury fell to 29 inches 95 cents. The 19th and 20th were entirely cloudy, and then the same fall re-occurred, after which it recovered, and maintained its former altitude to the end of the month. Harvest, meanwhile, advanced rapidly, and I should say finely; but the farmers began to report blight and mildew, which diseases, therefore, were bruited far and wide. If any real mischief existed, it had its origin in the sudden and oppressive heat of the period herebefore tabulated. The average temperature of all the days and nights was 72½° and 62°.

August.—The barometer declined gradually from 30 in. 10 cents between the first day and the fourth, when it stood at 29.98. The weather table gives the following particulars:—1. Cloudless, very hot sun. 2. Cumuli afternoon. 3. Most beautiful red-glowing sunset. 4. White cirro-stratus clouds, crossing, and towards evening becoming black: the heat of day and night on the average of three observations was, as nearly as possible, 67°. The *prognostic* (if so it may be termed) of the oak's predominance over that of the ash, afforded further evidence of its correctness. The dry, and generally hot weather of the summer may be cited as conformable with that of the years 1844 and 1846. Future observations may confirm or confute the theory; especially if the converse positions

occur, which must be speedily anticipated. Changeable and rather showery weather succeeded, and partially arrested the progress of the wheat harvest that had commenced; and also roused the fears of some farmers, who became hasty in their operations. We experienced a greatly depressed thermometer, and lively western currents with little sun, till the tenth evening, when the barometer again rose to 30 inches. From that time it continued to rise to 30·3, the mark of the 15th day; then it receded gradually to 30 inches on the 21st. The wind fluctuated between north and west chiefly; but changing to north-east on the 14th and 15th, we noticed corruscations of lightning on the evening of the 14th, among the black masses of eastern clouds, and this recurred on the 15th. These electrical phenomena terminated with a few rolls of distant thunder on the 16th, after which, haze, a few showers, and moist, drizzling rain, followed for three successive days.

The temperature was again reduced to below 65° max., with a little falling weather till the 23d, when the mercury rose above 30 inches, and continued high (30·38, receding to 30·05 cents) to the end of the month.

After the 23d, the weather again became brilliant with the sun, but the heat, unlike that of 1846, returned no more; the nights were read off at about 59° average—very mild and equable: the days at 65° 5 cents. The averages of the entire month of August were 67° 93, and by night 57° 90 cents. Rain fell on eleven of the days, but in quantity wholly inadequate to the requirements of turnips and pasture grasses; the latter were burned up to parched aridity. Meanwhile the harvest progressed to its most beautiful and propitious conclusion.

September to the 11th inclusive was fine; a few light showers fell on the 3d; more on the 7th and 8th; they just moistened the earth sufficiently to confer a little verdure on the grass lands. The turnip meanwhile (always excepting *Kohl*) languished on. Beans were very little better than failures, but the deeply ploughed lands whereon the plants stood in rows 27 inches apart gave exceptions. The harvest was entirely housed. Temperature fell steadily, and the night barely averaged 45°. The wind fluctuated between north-west and south-west. Barometer, average about 30 inches.

In the second period of the month to the 23d inclusive, the wind was westerly, deviating only now and then to the south-west. There were three fine and sunny days; in the others were more or less rain, and on the 18th, a little hail. The wind blew fiercely from the west on the 16th for the first time. The barometer fluctuated between 30 inches and 29·58 cents till the 20th day, when it rose to 30, and continued very high to the end. The *equinoctial period* approached; and now we must be more particularly minute. 21 mercury 30·14; wind south-west, gentle; small rain for so

hours. 22d. A most beautiful sunny day; wind south-west; barometer stationary; thermometer, 55°, 65°, 58°. 23d. The *Equinox*, 4·22 minutes, afternoon; sun in the autumnal sign *Libra;* barometer, 30·10; thermometer, 55° to 65°; wind south-west; cloudy day; fine evening. 24th. Wind had changed to north-west; barometer had risen during the night to 30 in. 23 cents; thermometer marked 50 inches 63 cents—53 at night; cloudy morning; sunny day. Thus, at the very critical minute of transition, appearances improved, after having been threatening for several days. The prognostic (if the term be admitted) became ambiguous, even within a few hours; what has been the result even to the very centre and depth of winter, we shall in a few pages be enabled to ascertain. The wind continued north-westerly on the 24th, the day of the full moon, (at 2 hours 25 minutes p.m.;) but it speedily changed —an event announced by the glorious halos (*parselene*) about 9 P.M. They consisted of rich-coloured circles, blue and richly-tinted, copper-brown, intersecting and blending in a manner far superior to the ordinary lunar circles. The wind became south-west, then north-east by north, and south-east, varying from point to point ; but the weather was on the whole fine through all these transitions, to the end of the month. The barometer was very high also, always averaging above 30·20 cents, and on the 29th day it marked 30 inches 38 cents. The extremes of temperature through all the days and nights were—maximum, 61°66; minimum, 48°1.

Every favourable opportunity afforded by showers, was seized to transplant from the seed-rows the smaller plants (about six inches high) of *Kohl rabi.* These plants had much the appearance of the brocoli put out in July; they had no bulb, nor does that form till the large leaves fully expand, and become horizontal in position. The large earlier crops were in fine bulb. It was interesting to observe the hardihood of these small nurslings; some were removed so soon as the ground could be turned and manured after wheat, but drought arrested the work; another partial shower fell, and again the line and dibble were in requisition. Thus, piece-meal, did the planting-out go on till October, yet not a failure or break occurred—a proof of the value of a vegetable which defies season and weather.

OCTOBER.—This month I divide into four very unequal periods determined by the prevailing winds; which also produced corresponding states of the weather, that were rendered worthy of notice by the quantity of rain, when compared with that which fell in October 1846.

The *first* period comprised one week to the 8th, wherein the wind was N.E., veering, at the close, to S.E., then S. The atmosphere was almost entirely gloomy, with some haze. Close rain fell on the 6th day, and there was lightning in the evening.

In the *second* period, from the 7th evening to the 11th inclusive, the wind was south-west. The 8th fine and sunny; at the close there was little sun.

The *third* period extended to the 18th, wind easterly, by north and by south. Weather generally cloudy, and sometimes foggy. The nights, in several instances, became much cooler, (48°,) but the temperature of the days continued very equable, (above 60°.)

Fourth period; from the 18th day, and thence to the end. Wind south-west, wavering now and then toward north-west. The general heat declined;—frosty rime was discovered on the 26th morning. A faint lunar halo was seen on the 19th evening, and another, of transcendant beauty, round the full moon of the 24th. Its tintings of blue, yellow, and copper-brown, were gorgeous:—the day had been showery. The great phenomenon of the autumn was the *aurora borealis* of Sunday evening the 26th. I saw it in the *west*, (not north,) about 9 o'clock: it assumed somewhat the form of an expanded fan, the diverging members being composed of *white* light, relieved by a suffusion of the richest crimson. General accounts of the surpassing splendour, variation, and durability of this phenomenon have been published in the papers. No results, however, were observed: a little inadequate rain fell—clouds were prevalent, and we had much mist and damp weather. Persons are apt to assert that we may expect 20 days of fine weather in October. We had, it is true, 21 *without* rain, but by no means 21 days with sun; and here it may not be irrelevant to state the average of rain which fell at Chiswick, as reported in the *Gardener's Chronicle* of the 8th January last. By the table it appears that, in October 1846, the rain-guages showed a fall of 5·54 inches, whereas, in October last, (1847,) the measure returned was 1·75, the difference amounting to 3·79 cents. It would be interesting to ascertain the averages of the entire kingdom. Our local temperature, in Surrey, as marked by three instruments, gave, as an average maximum, 59° 87 cents; minimum, 48° 3 cents.

November.—The first day of the month was brilliantly sunny. Barometer at 30·36 cents; thermometer 52° rising to 60° (78° in the sun;) wind gentle—south-westerly. Second day, 2 degrees warmer, the weather fine till 4 o'clock P.M., when dense fog came on suddenly, and a hazy atmosphere, with change of wind to east, followed; the temperature was reduced 10°. On the 8th and 9th the mercury fell to 29·73 inches, with lively wind at south-west; the latter day and the 10th were very fine; and then again the mercury sprang up to 30·24, and rose, with a few intermediate variations, till, on the 19th day, my instrument was read off at 30·40 inches. During the three first weeks, we at Croydon could register only 9 days wherein, at considerable intervals, a shower or two, and some small misty rain fell. The days and nights were mostly cloudy. On the 18th the first gentle frost, at 32°, occurred:

it increased, and the morning of the 19th dawned with 4°, (*i. e.* 28° of Fahrenheit,) a degree which killed the dahlias, heliotropes, and salvias of the garden. The day became perfectly fine, and I observed a pellicle of ice on some stagnant water. A great change took place on the 20th, with deep yellow fog after a very slight frost. Commencing with the 21st, I shall be a little more particular. My diary states it to be "changeable, with a shower, brisk air south by east at night. 22d, changeable—fine forenoon—wind (south-west) and rain in the evening. 23d, much rain before noon, fine afternoon and night. 24th, fine and sunny. 25th, (south-west brisk wind,) gloomy. 26th, variable wind—thoroughly wet. 27th, misty and quite wet. 28th, a rainbow—broken, dark grey clouds and showers. 29th, very beautiful—bracing westerly breeze. 30th, broken heavy clouds,—fine night,—temperature, 37°, max. 54°, night 53°. The last ten days were, therefore, the rainy period of the month; the barometer marking a low average, or about 29·60. The Chiswick table of rain quotes, in November 1846, 1·48, in 1847, 2·26. Average temperature of the whole month, by my table, max. 46°, min. 43° 34 cents.

DECEMBER opened with splendour;—the first day was beautiful, and, strange to say, the mercury of the barometer had risen, during the night, to 30·25 inches; thence, on the 2d, it advanced to 30·38; but gradually fell a few cents, till, on the fourth morning, it marked 30·2, and in the evening only 29·70: the prevailing winds were west by north and west by south: temperature of the nights 42°, and of the days 53°. A little rain fell on the 2d and 4th. The barometer declined rapidly, till on the 6th morning my instrument stood at 29 inches. Some London tables marked a greater depression. Stormy wind and rain followed. On the 7th, I marked the greatest depression of the year, 28 inches 76 cents; yet the wind, during these three stormy days, was north-westerly! The mercury rose, and, on the 8th, we had a ground frost at about 31°, by the suspended thermometer—the surface of some ponds being slightly filmed with ice. It is here proper to observe, that some of the discrepancies of weather tables may be partially accounted for by the position of the instruments. For instance, in the Chiswick register, as given in the Gardener's Chronicle, we find very low night averages, while those of the day appear extremely high. If an instrument be laid upon the grass, the mercury will frequently recede 10 or more degrees lower than in another which is suspended only three feet above the surface: hence, we commonly see a frosty rime upon herbage when the air through which we pass indicates 35 or even 40 degrees. I employ these thermometers: one a "Sixis," self-registering, suspended where sun can never reach it: another, for the night only, filled with red-tinted alcohol, also suspended: the third, mercurial thermometer, is placed against a perfectly shaded wall, very little above the earth of a garden-

border; but they all accord very closely, and never mark any remote extremes. Hence we may rest assured that the conducting power of the herbage can never be manifested unless the *ball* of the thermometer be *in actual contact* with living vegetable substances!

Subsequently to the 8th, we had south-westerly winds till the 16th; the current then varied to south and south-east till the 19th, inclusive. The temperature was very mild: the weather rather sunny from the 11th to 16th; the remaining days being occasionally wet; however the quantity of rain was but small. On the 20th, the wind became north, then north-west, fixing in the north-east to the 31st; on that, the last day of the year, it went to south-east. During these eleven days there was one only gleam of sun at his rising, otherwise the whole period was overcast. A more gloomy and unjoyous Christmas has seldom been witnessed; it was a just representative of the condition of the land,—depressed in its financial affairs, and over-run with a violent and destructive *influenza*, which aggravated the character of all the other maladies that became so peculiarly virulent. Fog prevailed throughout the 24th, 25th, 28th, and 31st; the other seven days were overcast with clouds, and five were more or less rainy. Here it will be pertinent to state, that in this month the quantity of rain, according to the table of the Chiswick garden, amounted to 1 in. 81 cents: that of the entire year being only 16¼ inches; whereas the average of 1846—dry and hot as it appeared to be at the time—bears 27¾ inches! The weather was cold and approaching to frost, (30° or 31° Fah. being the lowest,) during the eleven last days.

The averages of the month, by my instruments, were,—min. 35° 16 cents, max. 45° 13 cents.

Rural life in Germany. (From the French.) As for the rural population, they are nearly ignorant of the use of animal food, and and their life is so frugal that the moralist may admire, but the political economist must deplore it. One may judge of this by the following anecdote:—

We spent a short time in the village, near to the royal domain of Scharnhaus, close to the gate of Stuttgardt, which contains 830 inhabitants. We lodged at the house of an excellent and worthy peasant, who united the work of a butcher with that of an inn-keeper.

This man was 33 years old, and had already four children; the freshnesss of his complexion, and his athletic proportions, made us suppose he had consumed a great deal of butcher meat; but see what he says to us:—"The regimen of peasants like me consists of three repasts in the day: in the morning of potatoes, before we dress, with some bread of spelt and barley (very black.) At noon, soup and some vegetables. In the evening, soup and vegetables, potatoes

or some other kind. For drink, cider of our own manufacture, if we have any; when the apple crop fails, as it has done this year, we have water. The rich only consume butcher meat: and I join with a butcher who is established in a village half a league from here, to kill a cow every week, and we divide the carcase between us; we sell the beef for 8 kreutzers a livre (6d. a pound); veal is the same price." Having asked him what he meant by rich people, he answered that he considered those rich who were possessed of 6,000 florins (£500.)

The above is too true a picture of the state of a country inhabited by a rural population alone; and well does a traveller point out the advantage which would certainly accrue to France, if the absurd financial restrictions, preventing the importation of butcher meat from Germany, were removed.

The Oat Grub.—It may not be generally known to farmers that the mischief frequently done to their oat crop, is principally done by the larva, or caterpillar, of the *Tipula olearacea*, commonly called Daddy Long-legs. This larva is exceedingly voracious, and as it continues in that state for nearly a month, the destruction of whole fields is easily accounted for. They do not, as is usually mentioned in books on entomolgy, destroy the roots, but they gnaw off the tender green oat, close above the ground; and then, dragging it to their hole, lie there and chew it, until it all disappears; when they again come out and begin with another stem. No one who has not paid strict attention to these insects, can imagine the quantity of food they eat. I cannot say exactly how long they remain in the chrysalis state. I kept some this summer, and find that they live about a month, as larva. The male is smaller than the female, and died immediately after impregnating the latter. The female lived about three days, and died after depositing about 30 eggs. I have no remedy to recommend for this serious evil. Some of my neighbours tried salt, but without any good effect.

M. B.

Practical Hints on the Draining of Cold Clay Soils upon Retentive Subsoils. By GEO. WM. HAY, Whiterigg, Roxburghshire.—Of the many important features to be attended to in the proper cultivation of the soil, nothing so forcibly calls upon the latent energies of the agriculturist for exertion as drainage; and it may justly be said, that, until recently, this was a subject which occupied less time and thought than perhaps any other—in fact one which was not systematically gone about; and even at the present day, when so much is said and written and done in the way of draining, how often do we find the greatest carelessness prevailing, not only in the cutting, but also in the more important matter of filling drains. We find the old prejudices still remaining,—we find, in too

many instances, landlords unwilling to avail themselves of this great boon which government has placed within their reach; and we also find the tenants refusing to pay an adequate proportion of interest upon money which their landlords are willing to borrow for their mutual benefit.

There is not the least doubt but that the Drainage Act of the last year will do more, throughout the length and breadth of the land, than any thing which has hitherto been done towards the subjugation of the soil,—enabling us to compete with our foreign rivals—in fact, to support our own population independent of foreign aid.

The spirit for thoroughly drying the soil had commenced some time prior to the government Act; and thus the expense between landlord and tenant was mutual in general cases,—the one party cutting, and the other filling the drains. In many instances, however, the whole expense was incurred by the tenant, and in too many cases it happened that the drains were superficially done—merely to serve the tenant's own ends during the term of his lease. Again, it often happened that the landlord, cutting the drains, left the tenant to superintend this, as well as his own portion of the work—the filling them in; and I am sorry to say that this is too much the case still, and that the work in consequence is executed, both in the cutting and filling, in a very inefficient manner.

And here it may not be amiss to remark, that it ought to be considered the duty, as it is the interest, of every proprietor to examine into the plan proposed to be adopted by his tenant for filling the drains, whether these be opened at the expense of the proprietor or not; for I hold that grievous injury may be done to land by injudicious and ill-completed work; and moreover, during the progressing of the works, that a competent person on behalf of the proprietor should always be in attendance to see that no part of the work be slighted, since so much depends upon the uniform good fulfilment of every part of the undertaking. Some tenants may not relish a surveillance by their landlord, but it is often much called for; and on the part of those tenants who understand the *theory* of draining, such care ought to be felt as cementing the bond of interest which subsists between the owner and occupier of the soil. But whether it is well or ill taken by the tenant, I would desire to impress upon the mind of every proprietor the absolute necessity of such a superintendant; much work of a slovenly and unsubstantial nature having come under my own observation where the tenant had been at the whole expense, as well as when the landlord was at the expense of the cutting.

A species of controversy has been going on for some time between the parties advocating the widely apart and deep draining, and those who maintain the frequent and more shallow drains, while the entire subject of dispute rests *upon the nature of the subsoil.* If there

be a porous and gravelly subsoil, or even should there be what is called a stiff clay of a uniform nature, or, as often happens in clay soils, that there is an impervious band of a few inches in depth below the soil, with a porous substratum, then the wide apart drains will draw well enough, provided always that the land be also thoroughly subsoiled; and the wider apart the drains are, of course they are required to be made the deeper.

But upon land where the soil is a thin cold clay, with an impervious, and what is called by workmen a chattery subsoil, consisting of hard blue and red till, with stones intermixed—in fact, a kind of concrete, in which is found at times large boulders,—then there is nothing for it but the frequent drains, certainly not farther apart than 24 feet, and 12 or 15 feet are nearer the mark; and these drains need not be of greater depth than 2½ feet, for the plough can only in rare cases get beyond the depth of 10 inches before it meets with the stiff till; and even supposing that the furrow is made of the depth of 14 or 15 inches, there still remain 15 inches, to the bottom of the drain; and allowing the drain to be filled to the depth of a foot, which is rather beyond than under the mark in most cases of stone drains, and very much beyond that of tiles—there will always be 3 inches of soil left untouched by the plough above the materials of the drain, which is space enough even over stones, provided they have been properly put in.

A depth of 2 feet may be objected to as too little, but in such soil and subsoil as I have described, 2 feet I would consider sufficient, were tiles and stones used, and the additional 6 inches are only given that there may be a proper covering to the drains when filled with stones; and either of these kinds of drains, in my opinion, constitutes a more efficient one on such land than tiles alone; for I hold that it is next to an impossibility that water can percolate through this subsoil; and we invariably find, that when the drains in such are opened, the water oozes through between the soil and subsoil, showing where the water has been retained, and that it does not rise, as is so often stated, from below; and the deeper the drain goes the dryer is the subsoil, and which would remain so at the bottom of the drain, were it not that after some time the oozings collect there.*

I allow that water does often rise into the bottoms of drains, but

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* That water cannot pass at all through a tilly subsoil is an opinion we believe to prevail very generally with farmers. It is by no means evident to every one why water should not pass through clay, when the purest clay is known to absorb and retain a large proportion of water, and when, on analysis, it is found to contain as large a proportion of silica as 60 per cent, and when the strongest clay soil yields in washing from 5 to 20 per cent of sand. We suspect it would be found more difficult to prevent water entering a drain from a tilly subsoil than to drain such a subsoil, when it is known that drainage—that is, the opportunity for the water to escape—entirely alters the texture of till.—EDITOR.

in that case the subsoil is of quite a different texture; indeed, it may happen in such a case that the subsoil has not been reached, and I know of such instances; or it may be that a stratum of sand runs through part of even such subsoil as I have described, and brings the stagnant water from a considerable distance, and then the deeper the drain through such stratum the more effective it will prove. But it rarely happens that we are so fortunate as to fall in with sand or porous matter; and it is on this account that I wish to prove to those who, like myself, have to do with tilly subsoil, the necessity of having proper materials for filling drains.

And in the first place, I would suggest that after the main drain is cut along the lowest part of the field, the parallel drains be cut up the ascent of the ground; for we always find that the strata are thus cut through, their ridges running with the slope, and the water sooner gets into the drain. The main drain should be cut a full ridge breadth from the ditch at the bottom of the field, and the drains should not run into the ditch, as is too often done, where they get choked up with the poaching of stock or other causes, which consequently renders the drains useless in a very short time.

This drain ought in all cases to be 3 inches at least deeper than the parallel ones, which should be cut sloping gradually from its depth into that of their own; and this is a better method than making a precipitate fall at the end of each drain, where there will soon be a wearing away of the soil, misplacing the stones or tiles, and carrying the sediment into the main drain, which ought at all times to be perfectly clear.

In the next place, I consider it of great importance that the drains be well cut,—that is to say, that they be nicely sloped from top to bottom, and without ragged edges or sides; and although it is not easy to make clean work when there are many stones, the better work will be executed by the better workmen, and it is safer to give a good price to good workmen than have work ill done; for there is a great saving in having drains clean cut, as it is often impossible to get them filled in close behind the cutter, and so much of the ragged work falls in even in a single day or two, that the cleaning of it out becomes a serious matter,—as much as a penny per rood I have known to be paid for throwing out the fallen in soil,—and if the drains are to be filled with stones they require more.

I come now to the materials with which the drains should be filled; and it is my conviction that stones alone make the best and most permanent drain. If the drains be well cut, and the stones broken small, and well riddled before being put in, to the depth of a foot, then levelled on the top, and the sod turned down upon them, I venture to say that nothing can surpass such a drain.

Next to this is the tile with stones, either a tile and sole, or a pipe-tile packed with stones and covered to the depth of 6

inches, which makes a most excellent drain; but I cannot say so much in favour of the tile and sole alone, for I hold that the greater the depth of material in the drain, and the greater internal surface acted upon by the air, the greater is the action of the drain, not only in making the surrounding soil more porous, but causing a more speedy evacuation of the surface water. It is too common a plan to use the tile without the sole, which is most objectionable, and ought not to be allowed by any proprietor that incurs the expense of cutting the drains — for even in the hardest subsoil, how soon will the water soften the bottom of the drains, and allow the edges of the tile to sink. Besides this, we daily see tenants allowing the drains to remain open until they are almost half filled with the soil from off the sides; and when this has been scooped out as it best may, there still remains a mass of mortar in the bottom into which the tile is placed, and into which the weight of the filling earth sinks them, until at least half the cavity is closed up. This is by no means an exaggerated statement; and therefore it is that I would impress upon proprietors the necessity of having some one on whom they can place reliance to be always on the spot, to see that the drains are properly cleaned and filled. I can state that I am aware of drains having been cut within the last six or eight years, which are now inefficient, and it is to prevent the recurrence of such an evil that I have expressed myself as I have done.

The *manner* of filling drains being of vital importance, I may state that hitherto I have made none but stone drains, which were cut in the best manner, and filled with quarried stones broken, which were put into the carts with brander-shovels. When a doubt of their cleanness existed, they were filled into the drain through a harp-barrow, a trust-worthy man following to level the stones and turn down the sod. These drains are working in the most satisfactory manner, and I conceive them to be the perfection of drains.

Some years ago I began to use tiles, but having been burnt with peat, they did not stand the weather, and I had to take them out again. This year I am using pipe-tiles with a 1¾ inch bore, of an egg shape, having a flat bottom, which I agree with Mr Stephens in considering as the best form of tiles, and trust to be able to show that they are cheaper than any other kind; and which I should like to do, seeing that tile draining is now much more in use than stone, because it can be more quickly done, with less injury to the land in wet weather, and cheaper. These pipes are made at the Haining tile-work, near Selkirk, which was established a year or two ago by Mr Pringle Douglas. But to show the prejudice prevailing against pipes, none of them were asked for until I requested a supply for a few acres. I hope that many will see the advantage of availing themselves of them, in preference to tiles and soles, unless they be deterred by the bugbear, by which many, even

intelligent men, allow themselves to be swayed, that they cannot see how the water can get into them, as if any unglazed earthen article can keep in or keep out water.

The price of tiles in this neighbourhood is 32s. per thousand, and the soles half that price, which makes their total cost 48s. per thousand; the pipes are sold at the same price as the tiles, and of course no soles are required; besides 500 of them can easily be put into a single-horse cart, whereas the cart will contain only 350 tiles, and 700 soles make a load. I give these numbers situated as I am about seven miles from three tile-works, and the roads not very good, and therefore cannot over-load the horses; but suppose it possible to put 700 of the pipes or 500 of the tiles upon a cart, the difference is still greatly in favour of the pipes.

The carriage of the material for filling drains is a serious cost; and if we can lessen it more than a third, and also reduce the purchase money a third, we are undoubtedly justified in at least making a trial of pipes.

There is another thing to be taken into account, which is, that moles cannot injure the pipe-drains if they be properly joined, but which they may the tiles without soles, or where only half soles are used. I had a fact of this nature exemplified in my own experience, when, in using tiles and soles for the main drain, I desired the man to lay the soles an inch or two apart, so as to make them run out to greater length; and the consequence was, that in the following morning I found a mole had worked up the soil through one of these openings, by which the main drain was choked. Fortunately the stones had not been put in, else the accident would not have been observed—thus showing the absolute necessity for carefulness in constructing drains.

I have found the most expeditious as well as the best manner of filling the drains is to have a man in them, the tiles and stones having been previously laid alongside. A woman accompanies him, and lays the stones forward upon the edge of the drain, while he is proceeding in the laying of the pipes, one by one, wedging and covering them with the stones as he goes along. This I find a preferable method to the one with which I commenced, of cautiously shovelling the stones from the cart upon the tiles, which, even with the greatest care, broke some of them, and the stones were not so well, or so quickly levelled as by the hand.

As soon as the laying of one drain is finished, whatever stones may have been left over by the man are now thrown in by the woman, who, after they are disposed of, proceeds to lay forward the stones for the next drain, while the man is turning down the sod upon the stones in the former drain, thus securing it against injury, and losing no time.

I am of opinion that the method adopted by Mr Hammond of leaving the drains open *above the sod* as long as possible is a good

one, and I shall make trial of it, that the air may act upon our stiff soil and subsoil, and hasten the draining results.

*Animal Excrements considered as Manures.**—It is always a pleasure to read a book when the author is in earnest on his subject—the importance which the question bears in his own estimation is sure to be communicated to his readers. It is in opposition to the most settled opinion of human nature to expect that we can interest others in that in which we are not interested ourselves. There can be little doubt but that it is to the earnestness with which they have treated their subject that the honoured names of Liebig, Boussingault, Johnston, and others are indebted to their present position. Though the author of the interesting work now before us has only treated on one subject connected with scientific agriculture, yet he has done so in such a clear, lucid manner as to merit our attention.

M. Girardin, in his introductory address, states that his greatest wish is to show, not *the theory, but the practice* best adapted to general use. His text is—

> The base of agriculture is manures; and of all manures, animal excrements are the best adapted to our varied soils and crops. Observation of the plainest facts must have shown you that good crops are insured by the abundant application of manures. But to manure well, you must have plenty of manures; and if you are unable to do the former, it is because you neglect the means within your reach of improving the quality and increasing the quantity of your farm-yard manure. Your own interest requires the immediate removal of this evil.

It is well known that the nature and properties of manures depend on, 1st, The species of animal from which they are derived; 2d, On the food given to them; 3d, On the substances with which they are littered; and, 4th, Especially upon the care bestowed upon their management.

1st, On the relative Value of the different Manures derived from various Animals.

From Birds.—The attention of the whole civilised world has been for the last few years directed to the desert shores of Africa and Peru, whence, between 1841 and 1844, England imported not less than 70,000 tons of the *excrements of birds*. This guano, or *huano*, (as it is called by the natives,) has undoubtedly proved of great utility to English agriculture; but its value has been very much diminished by the unscrupulous manner in which it was adulterated, rendering it impossible for any one but a scientific chemist to judge of its worth. Nothing can be more fallacious than to form an opinion of the value of guano by its smell or appearance. Suppose the farmer possessed of a genuine sample, he will much "improve its quality by the addition of a small quantity of gypsum

* Girardin, 5th edition.

or charcoal, both of which substances have the property of absorbing free ammoniacal gas."

Our author states as his opinion, that "it is impossible that the aquatic birds of our present geological period can have produced the immense deposits found on the shores of Peru; there is, therefore, every reason to believe them to be *capriolites*, or fossil excrements of antediluvian birds." Though we believe this subject has never been carefully examined, yet it seems likely that Girardin is mistaken in the above assertion. Without seeing the place, we can form no idea of the countless myriads of birds which flock to those shores century after century. Besides, seals have been found imbedded in the guano of the same form as those which still exist in the adjoining seas; and in one case a human mummy has been found.* We are not without hope that the fossil animal excrements, or capriolites, will ultimately be used in agriculture. They are known to exist in considerable quantities in some parts of England, especially in oolite, and contain the same chemical substances as the modern deposits. It has even been shown that *urea* exists in some of these capriolites; thus making them agree, to an unexpected extent, with the dung of birds now living.† We know of few more interesting discoveries in modern chemistry and geology than the above, except that of the little aquatic animal yielding sepia in a fossil state, when it had been entombed for countless ages, and yet furnished sufficient of its own peculiar colour as to enable an artist to paint its own likeness. The English farmer will be surprised to learn, that in Flanders it is customary to pay £4 per annum for the dung of 600 to 650 pigeons.

"The following analyses of the dung of pigeons and barn-door fowl will give an idea of their comparative value:—

	Pigeons.	Poultry.
Water	79·00	72·00
Azotised vegetable matter	18·11	16·20
Saline, or mineral ditto	2·28	5·24
Insoluble matter, sand, &c.	0·61	5·66
	100·00	100·00

Both these substances have been applied with success to clover when mixed with charcoal."

Johnston, in his *Agricultural Chemistry*, has given a recipe for artificial guano, which has not, however, as yet fulfilled every expectation. But we doubt not, in a few years, to see that substance successfully imitated.

The excrements of herbivora.—"These manures may be ranged in the following order, to show their relative value:—1st, The sheep; 2d, The horse; 3d, Horned animals; 4th, The pig." Here again it must be stated, the relative value of these substances depends

* *American Journal of Science.* † *Journal of Geological Society.*

on the food given. "By way of companion with the above analyses of pigeon and poultry manure, I now add the following of—

	The Cow.	The Horse.	The Sheep.	The Pig.
Water . .	79·724	78·36	68·71	75·00
Azotised matter .	16·046	19·10	23·16	20·15
Saline ditto .	4·230	2·54	8·13	4·85
	100·000	100·00	100·00	100·00"

It may be necessary to add, that in the above table, which places sheep manure at the top of the list, it is not the simple excrement which is alluded to. In many parts of Europe the sheep are kept in folds, where, by the constant treading of their feet, they press the dung and litter into such a compact mass as to prevent fermentation, and consequent waste of ammonia. "It is beyond dispute that the *fertilising power* which shows itself with the greatest promptitude, is also that which is soonest exhausted. In this respect the excrements of the various domestic animals vary as much as in chemical constitution, and is an item not to be overlooked in estimating their relative value."

"According to Boussingault, fresh horse-dung (when dried) contains 2·7 per cent of azote. The same substance when allowed to ferment, as it does in practice, will contain *only* 1 *per cent of azote, and loses besides nearly* 9-10*ths of its weight.*" This gives some idea of the waste which always attends the practice of neglecting the manures of the farm.

One mode of manuring the fallow land, which is practised in France, and some parts of the south of England, particularly in Wiltshire, adjoining the extensive chalky downs, requires notice. It is there usual to fold the sheep with hurdles every night on the bare fallow, and shift their lair every night, so as to cover the ground during the season. There are hundreds of acres in Wiltshire which receive no other manure than by this antediluvian process.

"Boussingault has recently published a table showing the quantities of each kind of manure required to replace 100 parts of good farm-yar[illegible] manure, from which the following is extracted:

[illegible]	[illegible]	[illegible] excrements of goat.	
[illegible]	do.	sheep.	
54	do.	and urine of horse mixed.	
[illegible]	do.	do.	pig.
[illegible]	[illegible] the solid excrements of hors[illegible]		
[illegible]	[illegible] mixed ex[illegible] of co[illegible]		
[illegible]	[illegible] the solid [illegible]"		

[illegible] necessary to guard our readers from a mistake; the above table is calculated on the principle that the quantity of azote [illegible] a sufficient guide to estimate the value of a manure. Though this is one part of the question, it is by no means the only one. [illegible]din, in another [illegible] of his book acknowledges himself in [illegible] on the [illegible]

Animal urine.—"The various urines may be classed as follows, according to their greatest riches, in—

Solid Matter.	Azotized Matter.	Saline Matter.
Urine of horse.	Urine of ox.	Urine of horse.
... ox.	... man.	... cow.
... cow.	... horse.	... ox.
... man.	... cow.	... pig.
... pig.	... goat.	... man.
... goat.	... pig.	... goat.

"If we suppose all these urines united in equal parts, 1000 parts of the mixture would contain 58 parts of solid matter, equal in fertilising power to as much guano." It is unnecessary to say more on the fertilising powers of urine; the point undoubtedly to be aimed at, is to avoid its waste.

The great inconvenience attached to this manure, is the extreme volatility of the ammonia which it contains. Various substances have been proposed to obviate this difficulty, the intention of all being to form less volatile compounds with the ammonia. "To effect this, we must add any one of the following substances, in the proportion given, to each 20 gallons of the urine:—

12 to 15 oz. of plaster of Paris.
12 to 15 oz. of Glauber salts.
10 to 12 oz. of sulphate of iron.
3 to 4 oz. of sulphuric acid.
9 to 12 oz. of muriatic acid."

We look forward with confidence to the time when the necessity for attention to the above advice will be properly appreciated by farmers.

The excrement of man.—The value of this manure is admitted in every agricultural country of the world. The chief difficulty attending it being the offensive and injurious smell remitted during its fermentation. To avoid this, it is in France converted into *poudrette*, by drying in the sun. This method is as wasteful as can well be imagined, nearly the whole of the ammonia being wasted by the process. "The *poudrette* is, notwithstanding, a very useful manure, as may be seen by the following analysis. It consists of—

Water . .	52·5
Ammoniacal salts ..	3·9
Azotized matter . .	18·1
Mineral matter . .	25·5
	100·0"

To avoid the wasteful process just named, it has been proposed to mix charcoal powder with the excrement,—this answering both the purpose of drying and rendering it fit for carriage, at the same time absorbing all the ammonia, &c. Gasparin mentions that the vegetable matter in the bottom of rivers, turf, spent bark, &c., have been converted into charcoal, and found to answer this end

exceedingly well. We have not before met with such a suggestion, but it seems worthy of notice. This forms the substance called *Salmon's Manure*, and is now extensively manufactured, both in Paris and other parts of the Continent. In some places the excrements are mixed with water until sufficiently thin to flow through a water-cart, by which means it is spread on the soil. It is indeed to be regretted that some method cannot be devised for rendering this substance available for general use. "In France not one-fifth of the human excrements are used in agriculture;" and in England we would say not one-tenth; and yet this is one of the most valuable manures in existence.

2d. *Influence of the food on the value of the manures.*—"It is a fact beyond dispute, that the well-fed animal gives more excrement than the ill-fed one; and that the healthy animal, particularly when fat, gives a much better manure than the lean and unhealthy animal."

By the experiments of Bloch, the proportion of manure to the food consumed, is (by weight)—

For the ox .	. 0·42
... horse	. 0·42
... sheep	. 0·40

But these results vary not only with the food given, but also "the condition under which the animal is placed. For instance, the milk-cow will give a much less azotised manure than that of the ox; because the azotised principles of the food are employed in the production of milk. For the same reason, observes M. Boussingault, the excrements of young animals form a much poorer manure than that derived from adults."

3d. *On the nature of the litter given to animals.*—It has been ascertained that the straw of our various cultivated plants is of very different relative value as manure. It is not, however, our intention to enter at too great length on this part of the subject, and we will only urge upon those interested in this question to waste no kind of vegetable matter within their reach. "And when they have not sufficient straw to absorb the liquid manure, we would strongly urge the use of sawdust, or even sand,—above all, waste *nothing*."

Without saying more, we give the following extracts:—"Oat straw contains a large quantity of potash: we may thence conclude, hat for a field to produce good oats, the soil must at least contain a sufficient quantity of that substance." There can be no disput-g this assertion, and it may, perhaps, in part explain why ...h beautiful oats are grown in the neighbourhood of the Cheviot Hills. There is a good deal of basalt in that district, which it is vell known yields a large proportion of potash. "The straw of uck-wheat contains a much greater proportion of magnesia than lmost any other of our cultivated plants. It may therefore be nferred that a favourable soil for this plant must contain plenty of nagnesia. These soils are generally very poor, yet seem the nea avourable fo he growth of buck-whea It is evident from

the above that the future researches of science will undoubtedly prove of great importance to practical agriculture."

Without entirely disagreeing from the above statements, it is also necessary to bear in mind that the presence of one substance alone is not sufficient to insure the vigorous growth of plants. Though potash and magnesia may be *necessary* to the growth of oats and buck-wheat, there are many other substances which we must at least allow to be *useful* to these two plants.

4th. *On the manner of treating manures.*—"Animal excrements constituting in every part of the world manures *par excellence*, we would naturally expect that every thing which bears upon their preservation and application would become the object of the most assiduous attention on the part of farmers. And yet it is too true that, except in very rare cases, there is no part of agricultural economy in which such deplorable ignorance and mismanagement is shown. On the greater number of farm buildings, it is left to the mercy of wind and sun; and in some cases the manure heaps are so arranged as if it was the wish of the owner to have them *washed clean*, by allowing the water from the surrounding buildings not only *to run into but also to run out of the heaps*. To put an end to such a state of things, so disgraceful to agriculture, it will, doubtless, require much time and exhortation; for nothing can be more difficult than to bring about any change in long-established customs, however absurd they may be." During the last three or four years, the formation of liquid manure tanks has been much advocated; and we cordially agree with the advocates for that system in urging upon farmers the necessity of avoiding waste in every possible manner. Though it seems to us that, if this last condition be attended to, it is of little consequence to separate the liquid from the solid manure by means of tanks, &c., the object to the farmer is to get both on to his land, and, if he does so by absorbing the liquid manure by his straw, &c., the end is gained as surely as by the formation of liquid manure tanks, which are absolutely necessary in but few ordinary situations.

"From the preceding statements we conclude that attention must be especially directed to the three following rules:—

"1°. To feed well, for the quantity of manure is in direct proportion to the quantity of food.

"2°. To litter abundantly, so that none of the urine may be wasted.

"3°. To feed all the year in the house."

Chemical composition and employment of manures.—"The best manure, or what may be called *normal manure*,* is that derived

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* Boussingault has assigned the following chemical composition to this normal manure, though we are at a loss to know how he has arrived at the conclusion:—

Water . .	79·30
Organic matter .	14·03
Salts, &c. . .	6·67
	100.00

from healthy cattle, receiving a proper mixture of dry and green food with abundance of litter. This manure, at the time when it is spread on the land, must have gone through a fermentation, not long enough to volatilise the principles contained, but sufficient to destroy the texture of the straw, &c., and give the whole a fatty soapy appearance. An important disputed question here presents itself. In what state should manures be applied: should they be left to ferment, or should they be applied to the soil fresh from the stables?" &c. It is somewhat remarkable that, whilst scientific men in all parts of the world have disputed the subject, it has been settled by our farmers in the Lothians and on the banks of the Tweed. It is there the practice, immediately after harvest, to cover the oat stubbles intended for turnips with manure direct from the fold-yards, as far as their stock will go, thus economising the best part of the manure, and at the same time getting the work well forward for the spring. We have not seen this plan adopted in any part of England, but would strongly urge a trial. "The care and attention which we have recommended to be paid to manures will at some future day, if not at present, be duly appreciated. It must always be borne in mind that '*manure is coined money*.'"

On town manures and composts.—By the former we mean the varied refuse which is within the reach of the farmers near large towns: their value is of course exceedingly changeable, being influenced by the demand and the substances present. One serious evil attending the application in large quantities is, that the corn is apt to be thrown out; whether this be caused by the violent fermentation of the manure, as Girardin states, or by some other disadvantage connected with it, we are at a loss to say. It is enough for us again to urge upon the farmer situated within the reach of this valuable assistant in his labours, that he ought to omit no opportunity of adding as much as possible to the manure produced at home. To those who are not so conveniently situated, we would recommend the formation of *composts*, and will endeavour to lay down the rules necessary for their guidance.

Quick-lime is a very useful ingredient in forming composts, as it causes the quicker decomposition of the vegetable matter, roots, &c., of which large quantities are yearly gathered together on all farms. It is necessary to observe that it must not be used in the same compost heap as common stable manure or guano, as it immediately drives off their ammonia.

Whale blubber and other *oily refuse* are also very useful; they are best mixed with soil, as their fermentation is by this means much reduced.

Burnt clay.—We need only point to the Rev. Mr Huxtable's practice with burnt clay, &c., to show that the value of this substance, both when applied alone, and in forming composts, as that gentleman has done, is but little over-estimated by scientific men. The chief value of this substance consists in the remarkable power

which burnt clay has of absorbing ammonia from the atmosphere; so that, when it is applied, vegetation is very much invigorated. We must again say that no manure is *good*, strictly speaking, for one good property alone, and would recommend either the Rev. Mr Huxtable's method, or the application of some other manure along with the burnt clay.

Peat ashes are of much greater value than generally supposed; though the common practice of allowing the peat to burn until it becomes a heap of red ashes, is both wasteful and erroneous. The fire should be carefully attended to, and fresh peat added, so that the heap is only slightly charred, which completely decomposes the vegetable acids present in the peat, and the whole is converted into a most useful manure.

M. Girardin enters into a long and rather tedious detail of a method recently proposed in France, called "*la méthode de Jauffret.*" It consists in watering a heap of vegetable matter, such as peat, with a solution of urine and fecal matter, causing the whole to ferment. The method seems tedious, and therefore ill adapted to general use.

Before closing this notice, we cannot help wishing cordial success to the recent attempts which have been, and still are making in various parts of the kingdom to manufacture manures. To those engaged in the speculation, we have only to say that success is within their own reach; manufacture a *genuine* good article, and they are sure to succeed. The shameful impositions which are now practised in London deserve the severest reprehension. At some future day we may publish analyses of some of these so-called manures, with the names of their manufacturers. We hope what has been said will direct the attention of our farmers to the subject, as being so intimately connected with their own interest. M. Girardin's book cannot fail to be of service in this respect. We only regret that he has not given his analyses more in detail; in this respect they are behind those given by Johnston and other agricultural writers. With this trifling exception, the book is an excellent one, and we think its translation into our language would add another useful and simple work suitable to a practical farmer's library.

M. B.

Kuhlmann's Researches in Chemistry and Agriculture.—Kuhlmann has, during the last few years, devoted great attention to various questions bearing very importantly on practical agriculture, and has published the result of his researches in the French journals. The whole has recently been reprinted in a collected form;* and we now purpose giving such a review of his labours as may be interesting to the practical farmer or general reader.

* *Experiences Chimiques et Agronomiques*, par F. Kuhlmann. Paris, 1847.

It has always been a matter of doubt and uncertainty amongst scientific men, to explain the formation of the nitre beds, which are found in various parts of the world. Notwithstanding this difficulty, as these deposits have become of great importance to manufactures, and are necessary for the preparation of gunpowder, persevering attempts have been made to imitate these natural products. They have so far succeeded that manufactories of nitrate of soda and potash have now become established in various parts of Europe. The process is generally a simple one, merely keeping together a quantity of decomposing animal and vegetable matter, along with chalk, or the rubbish from old buildings. When these have lain a sufficient time, the nitrate of lime is washed out, and decomposed by carbonate of potash or soda.

As already named the theory of this action has never been understood, and more difficulty seems to attend the attempts at explaining the formation of the natural nitre beds, as they are often found where no vegetable or animal matter now exists. In this case it has been usual to attribute the formation of the nitric acid to the passage of the electric fluid through the air in the dreadful thunder-storms to which those latitudes are subject where the natural nitre beds are found. Nitric acid having been detected in rain water, fallen after thunder, there can be no doubt that it is formed in that manner; but it is very questionable whether it takes place to such an extent as to supply the enormous quantity of nitric acid existing on the plains of South America. It may be remarked that the only difficulty is to account for the formation of the acid, as the soda or potash is certainly derived from the rocks in connexion with which the saltpetre is found. In cases where this occurs, without the presence of animal or vegetable matter, it must not be forgotten that the saltpetre may be the result of a *process long since finished;* and for this reason its formation will appear inexplicable, as it is not now going on, and the conditions which gave rise to it have long ceased to exist.*

In the artificial nitre beds, there can be no dispute of the origin of the acid, as its quantity is in all cases found to be proportionate to the quantity of decaying animal matters present. The nitric acid is now attributed to the oxidation of the ammonia, produced by their decomposition. It is very curious that the presence of an alkali seems also indispensable; so much so, that Liebig [illegible]s nitric acid is only formed when the *fixed* alkalies, or earths, are present. Kuhlmann's researches render it extremely probable that, when none of these are present, ammonia itself acts the part of base.

Having then been clearly understood whence the nitric acid of the artificial formation is derived, we see but little reason why a dif[illegible] [illegible]s required for the natural ones. It is well

* [illegible]napp's [illegible]chnol[illegible]

known that all limestone rocks (in connexion with which we believe all the natural formations are found) contain ammonia, which is, of course, ready to perform the same part as in the artificial arrangements.

There is also another curious circumstance connected with this subject. It appears that the temperature of 32° F. completely stops the formation of nitric acid; not less than 60° F. being required to carry on the process vigorously. As the temperature of the greater part of Europe is, during the winter, under 32° F., it affords a plausible reason why so much more nitre is formed in hot climates than in our cold countries.

Of the application of this question to agriculture, our author has given an ingenious and beautiful theory. He thinks that, at the surface, the ammonia is fixed by conversion into nitric acid; which, when carried deeper into the soil, becomes re-decomposed into carbonate of ammonia, in which state it is absorbed by the plant. The question is an interesting one to the farmer, and, when fully understood, may prove of great importance, by enabling us to understand the action of various manures, in the application of which we have no guidance but the blind and often senseless proceedings of our predecessors.

There is one very striking characteristic of French writers, to which our author is not an exception. Having, in the course of his researches, unexpectedly discovered a method for producing nitric acid, which, he remarks, is not in our present condition of any importance, he yet seems to burst with rapture at the importance of his discovery; as in the case of a continental war, when the ports of France might happen to be blockaded, so as to render it impossible to receive supplies from abroad, they would still be able to manufacture nitrate of potash for conversion into gunpowder.

It is, however, to Kuhlmann's researches on manures that we would wish particularly to direct attention. Setting out from the above conclusions respecting nitrification, he has made a long series of experiments to ascertain the value of various manures; more especially of those containing azote, or, in other words, both those capable of yielding ammonia by their decomposition, and those which already contain it. He has formed the following conclusions:—

1st. *Ammoniacal manures* (such as the sulphate and muriate) are quite as efficacious as azotised manures, (such as rape-cake and various other substances,) the produce being in exact proportion to the quantity of azote present.

2d. *Nitrate of soda* is the most powerful of all these salts, as indeed he had expected to find it, from knowing that it contained the greatest proportion of azote.

From this step he again proceeds to inquire—

1st, If the active influence of these manures be entirely depen-

dent on the quantity of ammonia present, without reference to their other constituents.

2d, If the action of the phosphates be similar to the ammoniacal manures; and

3d, If the non-azotised, or carbonaceous part of the manures, is of any service.

To answer these important questions, 17 different manures were tried. Amongst others, sugar and starch (which are compounds of carbon) were tried, to settle the third inquiry; and, as they did not increase the product, Kuhlmann has decided that the carbonaceous part of our ordinary manures is of no value. As it is by no means certain that in the substances *sugar* and *starch* the carbon was in such a state of combination as to act beneficially, we think this conclusion premature.

Though still further confirmed in the previously expressed opinion that the value of manures may be estimated by the quantity of azote or ammonia they contain, some benefit is to be attributed to the other substances present; in other words, that nitrate of soda was more beneficial than nitrate of lime, which effect he attributes to the soda.

The phosphates did not produce the same invigorating or stimulating effect which the azotised manures did, though their action was more lasting than the latter. It is somewhat singular that there seems to be a limit to the beneficial action of ammonia, as a superabundant application actually decreases the amount of produce. It seems to act as a poison.

Amongst the numerous substances tried, azotised manures alone seemed to act as stimulants to vegetation,—this stimulus being in exact proportion to the quantity of azote they contain. It was also ascertained that non-azotised saline and organic substances, when applied *alone*, (that is without ammonia,) were very inefficacious manures. The next experiments were undertaken to ascertain what would be the effect of the *continued application of these various substances on the same ground.* The field was also left one year without any application, to ascertain *the duration of their beneficial effect as manures.* The results obtained are exceedingly interesting and important. It was ascertained that where the ammoniacal manures [illegible], though there was an increased product on the [illegible] compared with those when no manure had been applied, yet in the second year (without manure) the plot of ground which had received ammoniacal salts the previous year, showed a slight falling off as compared with the plot which had received no manure [illegible]er the first or second year. It was found that a second addition of azotised manures on the third year again gave a favourable result [illegible] the same as stated in the previous [illegible] the phosphate of lime and soda gave [illegible] increase [illegible] both the first and second year;

unlike the ammoniacal salts, which, as already named, showed a falling off.* Chloride of calcium (muriate of lime) always produced an injury to vegetation. It is somewhat curious that, notwithstanding the vigorous growth produced the first year by the application of ammonia, the same result was produced the third year. Though Kuhlmann does not make the remark, we are satisfied that, however beneficial these last-named manures might prove for one or two years, it is certain that, as they only act as stimulants, their continued use *alone* must tend to impoverish the soil.

Setting out again from this second conclusion respecting the value of ammoniacal manures, another series of experiments was tried, to ascertain their value when mixed with various saline manures; namely, to find out what substances were the best, to obviate the inconveniences which must result from the impoverishment of the soil when ammonia alone was added. It must be obvious that different saline manures would be required for every different crop. Kuhlmann has confined his inquiries to the growth of meadow-hay, assigning as his reason, that it would be difficult to place any other crop in so nearly the same circumstances of soil, &c., year after year.

The silicate of potash, carbonate of soda, phosphate of soda, phosphate of lime, tobacco ashes, common salt, plaster of Paris, chalk and lime, both alone and in conjunction with muriate of ammonia, were the principal substances submitted to this second experiment. The results have been very satisfactory. We must refer the reader to the elaborate tables in the work itself for full information, whilst we briefly state that common salt, when mixed with muriate of ammonia, produced the best result. This deserves attention, especially as this mixture is cheap, and no skill on the part of the person using it is required. Kuhlmann recommends 2 cwt. of each to an acre of grass-land. It is hoped that some of our enterprising farmers will be induced to give it a trial as early as possible.

The whole series of experiments is very satisfactory, and conducted with a very proper spirit. It is only to be wished that an analysis of the soil, on which the trials were made, had been given.

Unlike many agricultural writers of the day, Kuhlmann has drawn all his conclusions from experiment; he has not, like them, *commenced with his theory*, and twisted all his results to make them agree with the preconceived opinion. On the contrary, the experiments are fairly tried; the inquiry conducted from step to step, and the deductions so modestly drawn, that every reader must feel himself compelled to agree with them, notwithstanding they differ from the expressed opinion of Liebig himself, who

* It may be necessary to say, that the whole of the field was left without any manure the second year, to ascertain the comparative length of the efficacy of the various applications.

has stated as his opinion, that plants derive all their azote from the air. Against *this opinion*, we may place *the conclusion* at which Kuhlmann has arrived, from careful and laborious experiments, namely,—"*That if the air can supply sufficient azote for vegetation, we can double that vegetation by the addition of azote to the soil.*" M. B.

Ergot of Barley and Rye. By Mr JOHN LAWSON, Elgin.—The form presented by ergot of *barley*, during the first stages of its growth, differs considerably from that when fully grown, at least it may be much more distinctly seen in the former state; and as it is only occasionally that a plant can be discovered when the ergot is in its first stage of growth, it becomes the more necessary to describe it. This subject may, perhaps, be best elucidated by comparing a diseased seed with a sound one of barley. But before doing so, I shall offer a few remarks on the normal structure of the seeds of wheat and oats, in order that the external organs of these seeds may be compared with those of barley. This will enable us to separate the appendages of the seed, so as to obtain a view of the parts that become changed in structure, as afterwards described.

In *wheat*, the seed, when fully grown, appears as a *naked* seed. That is, the corolla, or chaff, by which it is surrounded, may very easily be separated by rubbing an ear of wheat in the hand. In *oats*, the calyx, or chaff, may be separated in like manner; but the corolla, called in oats the husk, adheres with more firmness to the seed than it does in wheat; so that, before we come to the naked seed considerable force is required, and in practice this is effected by an operation performed by a corn-mill.

Barley differs considerably both from wheat and oats, inasmuch as the corolla adheres with such firmness to the seed of barley as to appear part of it when the seed arrives at maturity; while the awn, which grows on the corolla of the barley plant, appears, when at maturity, as if growing on the back, and out of the upper part of the barley seed.

For some time, however, after a seed of barley has assumed its proper form, but before it has arrived at maturity, the corolla is not more attached to the seed than in oats, if so much. If at this early stage we examine a barley plant, it will be found that the corolla may very easily be separated from the seed, aud that the seed will appear as a naked one, with the glumes of the corolla on each side of it, as in fig. 1.

Fig. 1.

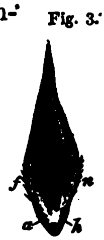
Now, if we remove the corolla, and look at the base of the barley-seed, we will observe this base (*within* the corolla) covered with two fine membranous substances, in the form of [illegible] the wings of a fly [illegible] *f*, in fig. 2 growing

out of the base *b c*.* The seed also grows out of this base, which is in the form of a flat oval disc.

Fig. 2.

Referring now to fig. 3, which represents a young ergot, or diseased seed of barley, we find a very great change of structure, both in the base and its feather-like appendages. The base, in this case, is of a pure white, and firm and polished like enamel. It has also assumed a different form. In a real seed, it is a flat oval disc—*b c*, fig. 2; in the diseased seed, it has assumed the form represented by *a h*, fig. 3. The feather-shaped membranes have likewise changed their form, and, instead of spreading over the flat side of the seed, have grown up in two tufts, *f n*, one on each side of the seed. Fig. 3 represents its appearance better, perhaps, than any written description that can be given of it.

Fig. 3.



From the foregoing account, we find that an important change has taken place in the *form* and *structure* of the plant at the *base of the seed;* and from what I stated on vegetable *morphology* in a former paper on smut,† I think we may conclude that a similar law has been in operation here, and that the production of ergot in barley arises from a change of structure, which commences at the *base of the seed*, and which the laws that govern vegetable morphology are found in other instances to produce.

I have been thus particular in describing the feather-shaped appendages at the base of the seed, and also the base out of which these feather-shaped appendages grow, in order to show the part of the plant where the change of structure first commences; and I may add, that I have never seen the slightest appearance of stamens in a floret containing ergot—neither is there any appearance in ergot of the two cups or sacs which are in the sound seed.

In *rye* the ergot presents a white enamel at the base of the seed, much like that in barley; so that in both plants the ergot is probably formed in the same manner.

In conclusion I may observe, that the methods adopted for preventing smut in wheat may probably also prevent ergot in barley and rye.

* The corolla of many plants is hairy or woolly at the base on the *outside* of the corolla, but that is not what is here spoken of. The membranous feathery appendages here referred to, both in their sound and diseased or altered state, are in the *inside* of the corolla, and *cover the seed*.

† See *Journal of Agriculture* for October 1846.

Leguminous Plants. By Mr PETER MACKENZIE, West Plean, Stirlingshire.—The extensive order *Leguminosæ* is one of great importance to the human race, whether we look at the number and variety of the plants contained in the order, or contemplate the beauty and utility found in individuals. The cultivators of the vegetable kingdom will find, in this large collection of plants, materials to exercise their skill in producing food for man and cattle. It may not be uninstructive to notice some of the more important leguminous plants that have been from age to age cultivated in fields and gardens, and also to point out others that should come in for a greater share of our regard than we have been accustomed to bestow upon them. Pease, beans, lentils, and various other kinds of pulse, have long been cultivated in various parts of the world as food for man; while those who turn their attention to the feeding of cattle, have not been neglectful of the growing of clover, lucern, vetches, saintfoin, and other plants of a similar nature. The cultivators of flowers have found delight in growing such families as *Kennedia*, *Wistaria*, *Glycine*, *Robinia*, and others that can scarcely be equalled in beauty, where all is gay. Also many useful drugs used in the arts, are produced from plants belonging to this order, such as the Balsam of Capivi, the Balsam of Peru, the Balsam of Tolu; and gums, such as Gum-Arabic, and also manna, by *Alhagi Maurorum.* We shall notice some of the more important plants of the order which are cultivated in our gardens as part of our food; and begin with the garden pea.

Pisum sativum, or cultivated pea, has been long grown in the gardens of this country, and at present there are many useful varieties of it in the market. It may be thought superfluous to say much about the cultivation of the garden pea, for almost every one that has a garden imagines that he can grow them; but, from many years' experience in their cultivation, we will say, without fear of contradiction, that there are some cultivators can grow them better than others. As it is a vegetable that is much sought after, various plans are tried to have it in a state fit for the kitchen as long as possible. When early crops are required, the soil should be light, dry, and sheltered; and if the soil is not very much exhausted, it will be [illegible] better to keep fresh manure from the peas, and, in most cases [illegible] earlier crop will be obtained. But for summer and autumn [illegible] heavier soil, which will hold moisture, is generally preferred, and [illegible] much labour in watering when the weather [illegible] where the soil is light and sandy, a [illegible] them greatly.

[illegible] the cultivation of the garden pea [illegible] is attended by a train of losses, such as [illegible] loss [illegible], loss of stakes, loss of manure, loss of time, [illegible] crop, and in many cases loss of patience. All these losses, and [illegible] kept in mind that peas

in gardens should only be sown in single rows, and that 1 lb. will sow a single row of 80 to 100 feet, a much greater return will be obtained. But such peas as Bishop's Longpod, Early Dwarf, and Queen of Dwarfs, will plant much farther; for, to have them in perfection, they must have room to grow, dwarf as they are; and when planted 2 feet apart, and 4 inches between each pea in the row, they generally do well when kept from mice and other vermin. It is of no use to describe half the varieties of peas that are offered to the public in various parts of the country, but for general crops we can trust to some of the old established kinds for a good return, with greater confidence than to many that claim our notice only because they have a higher-sounding name.

Many good gatherings may be obtained from a single row of peas; and although they will not give a return equal in bulk to a good crop of potatoes, perhaps as much nutritive matter for the support of the body will be had, as from a crop of early potatoes on the same space of ground. According to Professor Johnston, in 100 lbs. of peas we obtain 50 lbs. of starch, gum, and sugar, and from 10 to 15 lbs. of gluten, albumen, and casein; and in 100 lbs. of potatoes we get only 12 lbs. of starch, gum, and sugar, and 2¼ lbs. of gluten, albumen, and casein; and we are informed that gluten, albumen, and casein are the most nutritious ingredients in our food. These figures should be remembered by those who cultivate vegetables for their own use.

Faba vulgaris, or Garden Bean.—The bean has been long cultivated in this country, and, like the pea, we are not told when it was first introduced; but it is the opinion of some, that the Romans were the first who brought it into notice in this part of the world. There are many varieties of the bean to select from, but some of them are more curious than useful. Most of them will grow well in a great variety of soils, from the stiff carse clay to the cultivated peat. For early crops, the early Mazagan is commonly recommended for planting in autumn in sheltered situations; but, for full crops, we have met with none that will yield a return like the broad Windsor and the improved Longpod. Like peas, they ought not to be crowded in the rows, and 1 lb. will plant a row of about 80 or 100 feet. Like many other crops grown in gardens, beans are all the better of having the earth stirred between the rows, and but little labour attends their cultivation, except drawing the earth about the stems when a few inches high, and keeping the weeds that may happen to grow among them in subjection.

Theory and practice agree that beans are highly nutritive as food, and the caution of Pythagoras has been brought forward in support of their nourishing qualities. It is reported of the old philosopher, that he said to his disciples, "Abstine a fabis,"—abstain from beans; and interpreters say that it was because of their fattening quality. Others, however, give a different interpretation, and that it means

meddle not with elections,—beans having been made use of by the voters among the Athenians in the choice of magistrates; but we will refer again to an authority already quoted. Johnston says, "In 100 lbs. of beans there are 40 lbs of starch, gum, and sugar, and 2¼ lbs. of gluten, albumen, and casein." We are also informed that, in the countries where slaves are worked in the mines at the hardest manual labour, requiring the greatest amount of muscular power, they must be fed on beans, as it has been found that no other description of food would enable them to perform the same amount of work to their masters.

Since the failure of the potatoes, various articles have been tried as a substitute, such as sago, rice, loaf bread, oat cakes, barley bread, flour scones, flour baked with beet-root,—also with Swedish turnips; but many who have used them, found none so cheap and nourishing as bread made from pea or bean meal. Many working men have had reason to be thankful for the health they enjoy since they came into this toiling world, and more especially during the distressing times that are past, when many felt the pinching hand of poverty and want press heavily upon them. Some who partook freely of pea-meal bread felt themselves stronger and better able to use the spade than when potatoes formed a considerable part of their daily food; and they believe that it is chiefly owing to such food that they are able to work as well as when they were 20 years younger; and whatever may be the fate of the potato in this country, they are resolved to let fewer enter their stomachs while they have to earn their bread by the sweat of their brow —for they now work it with greater ease to their body and mind, and perhaps greater satisfaction to those by whom they are employed, than when potatoes were so much in use. Others we find who were often troubled with complaints of the stomach, and spent considerable sums in purchasing medicine, who have now no need of it, since potatoes have in a great measure been relinquished by them. There are many things more agreeable to the taste than food manufactured from the meal of peas or beans; but it is surprising how habit reconciles mankind to many things which at one time they could not endure—but health and strength are blessings that ought not to be parted with for every trifle. There are many who eat bread in which bean meal forms a greater part than many are aware of. We are informed, upon very good authority, that a small quantity of beans is generally mixed in many parts of the country with new wheat when ground to flour. The millers pretend that soft wheat will not grind well without beans, and they generally contrive that there shall be no deficiency in the approved proportion: and thus a quantity of beans is generally converted into what is considered wheaten flour. This practice is well known to all bakers and dealers in flour; and as there are means of discovering the quantity of bean meal in the flour, the ignorant and unsuspecting only are deceived, and the

price of the flour to the skilful purchaser varies according to the proportion of admixture.

Phaseolus vulgaris, or Kidney Bean, also called French Bean, and Haricot Bean.—There are many varieties of this bean, and they are commonly divided into dwarfs and climbers or runners. As they are used to a greater extent in some countries of Europe than in Britain as an article of food, it may not be out of place to make a few remarks respecting them. It is long since it was suggested by Speechly that the culture of the kidney bean might become an object of national or field culture in this country, and be particularly useful in times of scarcity; more especially as on good land it will flourish and grow luxuriantly, even in a dry parching season, in which respects it differs from most other culinary vegetables.

The scarlet runner bean may be cultivated in many parts of the country, and prove both useful and ornamental. One mistake in the cultivation of this vegetable in this country often occurs, that is, planting them too early in the season, for the seed is liable to rot if the soil is not warmed sufficiently by the sun before the seed is put in the earth. Where the soil is dug deep and well broken, and the seed put in at the proper season, many a gathering may be had from a row of scarlet runners.

We once knew an English labourer who had enough to do to rear a young family upon his slender income, who made the experiment whether potatoes or scarlet runners yielded the greatest quantity of food for his family from the same space of ground. He neither weighed nor measured the amount of the produce of each lot, but noted down the number of dinners each lot gave his family, and the greatest number were on the side of the scarlet runners. It was the green fleshy pods that were used, and not the ripe seed; and where such plants are required to bear pods for a long time, none should be allowed to ripen their seed. The following notice from the *Gardener's Chronicle*, on the same subject, may be worth recording:—

"A very poor family in Shropshire being hardly pressed for food, the husband being unable to get employment, the wife bethought herself of some kidney beans she had by her, and put some in an earthen vessel containing a sufficient quantity of water, a few lumps of bacon, with a little seasoning of pepper and salt, and placed them in an oven to stew two or three hours, till they became as tender as the best boiling peas. The peasants were agreeably surprised to find that the beans, which they fancied unfit even for the food of pigs, would thus furnish them with a nice mess, for they did not know that such seeds are served up at the tables of the wealthy in this country, under the name of haricot, and are generally a favourite vegetable with continental nations. Hitherto it has been the universal custom in this country to throw away the dried beans of the scarlet runners, if not wanted for seed. We trust it will henceforth

be remembered that excellent food may be had from one of those plants which now is made to scramble over the hedges and walls of a cottage garden chiefly for the sake of ornament."

From the experience we have had in the cultivation of kidney beans, we would be ready to say that to the people of Scotland the tender and succulent pods would be better adapted to the climate, and more to be depended on, than the ripe seed. Some seasons it may ripen, but in many situations of the country the early frost would kill them before the beans were fit for being preserved; whereas, if the pods were only expected, large quantities might be preserved in good condition. The mode of preserving them for winter use, and a plan of a machine for slicing the pods expeditiously, are given in the *Penny Cyclopædia.*

"The French bean, as an esculent vegetable, is wholesome and nutritious in a fresh state, and may be readily preserved for winter store or sea voyages, by salting in casks. For this purpose the large flat podded Dutch white runner is preferred. In Holland and Germany, where large quantities are salted in almost every family, a machine is used for cutting them expeditiously, which greatly resembles a turnip slicer; and may, with a small alteration, be used also for slicing cabbages when making the national German preparation of sour kraut, (*sauer kraut,*) &c."

We are taught, by those who have long studied the subject, that all substances susceptible of digestion and assimilation may come under the denomination of food; but the proximate principles of organic bodies, on which their nutritive powers depend, are comparatively few. Hence, although the articles employed in different countries for the support of animal life are various, their sustaining powers may be referred to certain substances capable of being separated and identified by chemical analysis and tests. Amongst the proximate elements of vegetable food, gluten, and its congeners, starch, gum, sugar, and lignin or woody fibre, are by far the most important; and amongst those of animal food, albumen, gelatin, casein, together with fats and oils, which are common to both kingdoms of nature.

The following table, by Professor Brand, shows the ultimate composition of 1000 parts of the following proximate principles of animal and vegetable food:—

	Carbon.	Hydrogen.	Oxygen.	Nitrogen.
Albumen . .	516	75	258	150
Gelatin . .	483	80	276	161
Fat . . .	780	122	98	
Curd of milk . .	609	75	116	203
Sugar of milk . .	454	61	485	
Gluten . .	557	78	220	145
Starch . . .	438	62	500	
Gum . . .	419	68	513	
Sugar . . .	444	62	494	
Lignin . .	500	56	444	

By the same author we are informed that there is another important point in the history of our food, namely, its ultimate composition. We have spoken of starch, sugar, gum, albumen, and other substances, as the proximate principles upon which we live. But what is the ultimate constitution of these secondary products? What are their true elements? It is curious that four elements only are principally concerned in the production of our food; these are carbon, hydrogen, oxygen, and nitrogen. Among vegetable substances, gluten, including vegetable albumen, is the only one which abounds in nitrogen—gum, sugar, starch, and the rest are constituted of carbon, hydrogen, and oxygen only; and what is very remarkable is, that in all these important principles, and also in lignin, the oxygen and hydrogen bear to each other the same relative proportions as in water, so that they may be figuratively described as compounds of charcoal and water. Now, there are two very curious points in reference to that part of the chemical history of our food which has been adverted to: the one is, that no animal can subsist for any length of time upon food which is destitute of nitrogen; and the other, that a certain mixture of different kinds of food is absolutely essential.

Before concluding our remarks at this time, we think the following table may be of use to those who may take an interest in such important studies. The proportion of nutritive matter in beans, compared with other grain, is, according to Einhoff, as follows:

	By weight.	Or in a bushel.
Wheat . .	74 per cent,	about 47 lbs.
Rye . .	70 „	„ 39
Barley . .	65 „	„ 33
Oats . .	58 „	„ 23
Beans . .	68 „	„ 45
Peas . .	75 „	„ 49
French beans .	84 „	„ 54

Professor Johnston "on the composition of the potato, compared with that of the mangold-wurzel, carrot," &c., says, in round numbers, the average composition of the dry potato may be represented pretty nearly as follows:—

Starch . . .	64
Sugar and gum . .	14
Protein compounds .	9
Fat . . .	1
Fibre, . . .	11
	100

We will conclude with the words of Dr Paley, who says, "that so far as the state of population is governed and limited by the quantity of provision, perhaps there is no single cause that affects it so powerfully as the kind and quality of food which chance or usage hath introduced into a country."

DECISIONS IN THE SUPREME COURTS CONNECTED WITH RURAL ECONOMY.

FROM 13TH NOVEMBER 1847 TO 21ST JANUARY 1848.

(Court of Session.)

Lands' Clauses Act—Railway Compensation—Payment of Amenity Witnesses.—The estate of William Younger, Esq., of Craigielands, in the county of Dumfries, was intersected by the Caledonian Railway, and the amount of compensation due therefor was settled by arbitration under the Lands' Clauses Consolidation (*Scotland*) Act, (8 Vict. c. 19.) That act provides, (§ 32,) that where the sum awarded is above what has been offered, "all the expenses of any such arbitration, and incident thereto, shall be borne by the promoters of the undertaking;" and the decreet-arbitral found the Company liable to Mr Younger in all the expenses of the arbitration and "incident thereto." When Mr Younger's account was tendered to the Company, payment was refused until it had been judicially audited. Thereupon Mr Younger raised an action to recover its amount, and the Lord Ordinary (Robertson) remitted the account to the auditor of court for taxation. Among the items of the account were various sums which had been charged by and paid to four country gentlemen, one of whom was a retired writer to the signet, who had been called by Mr Younger as witnesses in the submission, to give their opinion on the injury done to the amenity of his property. These sums were at the rate of L.3, 3s. and L.4, 4s. per day for time and trouble, besides the expenses of travelling and maintenance. The auditor, proceeding upon the Act of Sederunt of 10th July 1844 for regulating the allowances to witnesses in jury-trials, disallowed the sums charged by these gentlemen for time and trouble. Mr Younger having objected to the disallowance of these sums, the Lord Ordinary reported the case to the Court, (Second Division,) with a note intimating his Lordship's concurrence in the views of the auditor; and the Court (Lord Moncrieff dissenting) repelled Mr Younger's objections, and consequently found the charges inadmissible.—*Younger* v. *The Caledonian Railway Company, 23d November* 1847. *Jurist*, vol. xx. p. 34.

Sale of Land—Term of Entry—Rents erroneously paid to Purchaser—Repetition.—Sir John G. Sinclair was heir of entail in possession of the lands of Easter and Wester Brims, in the county of Caithness, when these lands were sold under the authority of an Act of Parliament, by public sale, for £9100, to James Sinclair, Esq. of Forss. The articles of roup, which were adjusted under the

authority of the Court of Session, stipulated that the purchaser's entry should be as to the houses, grass, and pasturages at Whitsunday 1823, and as to the whole arable lands at Martinmas 1823; that is to say, he should have "right to the rents, maills, and other duties from and after these respective terms." At the time of the sale, the lands were occupied by a tenant under a current lease, granted in the year 1807, which declared the tenant's term of entry to be as to the whole houses, grass, and pasturages, at Whitsunday 1807, and as to the whole arable lands at the Martinmas following, and whereby the tenant was bound to pay a rent of £350, one-third at Martinmas and two-thirds at the Lammas thereafter, "beginning the first term's payment of one-third at Martinmas 1808, and the remaining two-thirds at Lammas thereafter 1809, and that for the crop and year 1808, and so forth yearly thereafter." On the 16th March 1824, Mr Sinclair received payment from the tenant of the one-third of the rent payable at Martinmas 1823, and on the 25th March 1825, of the remaining two-thirds which were payable at Lammas 1824. In the year 1831, Sir John G. Sinclair claimed these sums as having been erroneously uplifted by Mr Sinclair; and this claim being resisted, in 1841 he raised an action in the Court of Session for the amount with interest. Mr Sinclair, besides denying the legality of the claim, pleaded that Sir John, by not making his claim for eight years after the sale, must be held as having acquiesced in the receipt of the rents by the purchaser; that the rents were received with the written sanction of Sir John's agent; and that they had been *bonâ fide percepti et consumpti* by Mr Sinclair. The Court, (First Division,) adhering to the main principles of the Lord Ordinary's (Cuninghame) interlocutor,* found Mr Sinclair bound to make payment to Sir John of the rents in question, with interest at four per cent from the year

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* The Lord Ordinary, in the Note to his Interlocutor, observed,—"When the purchaser's entry is declared to be at the term, or with a crop specified in the contract of sale, the purchaser has right to the rents payable for the subsequent possession, while the rents exigible for *prior* possession belong to the seller. . . . In some cases, an elliptical form of expression, used occasionally in clauses of assignations of rents, leads to misconstruction—as, when it is provided generally that the purchaser shall have right to the rents falling due after the 'term of entry,' which may lead to difficult questions when the term of entry is not well defined, or occurs in the middle of a crop. But there is no reason for that plea, when, as is the case here, the term of entry or a double term of entry, assigned to a purchaser, demonstrates with precision *the crop* to which the purchaser gets entry. When that is clearly designated, the purchaser can only claim the rent of the *crop of entry* and subsequent crops, leaving the prior rents to the seller. . . . The case is the same as if it had been provided, that the purchaser should enter *at crop* 1824, and draw the rent of that and all succeeding crops." With regard to the sanction of Sir John's agent, the Lord Ordinary remarked, "that it was written long *after* the sale by which the defender's obligation was constituted. In that case, an erroneous construction by a man of business of a legal instrument can never bind the client. Still less can it have that effect when the rights of parties are adjusted, as here, by articles of roup, prepared and issued under the sanction of the Court."

1831, when intimation of the claim had been made; under deduction of certain public burdens applicable to the year preceding Mr Sinclair's entry, which had been paid by him.*—*Sinclair* v. *Sinclair*, 1*st December* 1847. *Jurist*, vol. xx. p. 49.

Landlord and Tenant—Game—Damages for injury to crops.—In the year 1839, John Wilson succeeded his father as tenant of certain farms lying contiguous to each other in the county of Fife. Of these farms, Sunnybraes and the Links of Lundin were held under a lease for 19 years from Martinmas 1830, and the Parks of Lundin under a lease for 18 years from Martinmas 1831, both having been granted by the late Sir John Drummond Erskine, the proprietor; Blacketyside was let for 18 years from Martinmas 1837 by Sir William Erskine's Trustees, and Muirton and Dargs for 19 years from the same date by Captain James Erskine Wemyss of Wemyss, the respective proprietors of the lands. There was no express stipulation regarding game in any of these leases. Sir J. D. Erskine having died in 1836, Captain Wemyss succeeded him as proprietor of Sunnybraes and the Links and Parks of Lundin, and in the beneficial interest in Blacketyside. The rent of Sunnybraes and the Links of Lundin amounted to L.90; of the Parks of Lundin to L.535; of Blacketyside to about L.329; and of Muirton and Dargs to L.140. In 1844 John Wilson, the tenant, presented a petition to the Sheriff of Fifeshire against Captain Wemyss and Sir William Erskine's Trustees, (who were Captain Wemyss and his brother General Wemyss,) setting forth that Captain Wemyss, by breeding, preserving, and otherwise, had greatly increased the game upon the farms, and praying for an inspection and valuation of the injury done thereby to crop 1844, and for payment of its amount. The Sheriff, before answer, appointed Alexander Wallace, farmer, Parkhill, and James Wilson, farmer, Fordie, to inspect and report upon the alleged injury. These gentlemen reported that damage had been suffered from game upon the Parks of Lundin to the extent of L.9, 13s.; upon Blacketyside to the extent of L.20, 5s; upon Dargs to the extent of L.13; and upon Muirton to the extent of L.2, 0s. 6d.—being in all L.44, 18s. 6d., exclusive of one field of oats, and the hay and grass crops, as to which they could form no opinion, as they had been cut before the date of inspection. A proof having been led, the Sheriff found the above sums due to the tenant, and also a sum of L.10, 13s., as damage done to hay upon Muirton. Against this judgment Captain Wemyss and Sir William Erskine's Trustees advocated, and pleaded, 1st, That, comparing the damage proved with the amount of rent, it was not more than would be committed by fair average stock of game which a tenant is bound

* See the analogous case of *Stevenson* v. *Moncrieff*, 12*th February* 1845. *Jurist*, vol. xvii. p. 205. (7 D. 418.)

to submit to without compensation; and, 2dly, That, with regard to Blacketyside, Muirton, and Dargs, the system of protection complained of had been in operation at the time their leases were granted.* The Lord Ordinary (Wood) reported the cause upon printed cases to the Court, with a note indicating an opinion adverse to the Sheriff's judgment, especially in regard to the farms of Blacketyside, Muirton, and Dargs. The Court (First Division) being of opinion that there had been an unwarrantable increase of game, and that the Sheriff had fairly assessed the damage caused by that increase, unanimously adhered to the Sheriff's judgment, with expenses.

In delivering judgment, the Lord Justice-General remarked. . . . "It has been sufficiently proved that proceedings are adopted under the authority of the proprietor, leading undoubtedly to the increase of the game, which proceedings entitle the tenant to damages. I do not look so much to what is called the artificial increase of the game,—the breeding of pheasants which has been spoken to,—but rather to the strict system of restriction and exclusion which has been practised; and, above all, to the fact that hares have immensely increased." And Lord Jeffrey observed,—"The stipulation of the common-law is, that though the whole industrial occupation of the farm is given up to the tenant, there is a tacit reservation to the landlord of all the game on the farm. But then, that being the ordinary condition, the tenant must be held to contemplate the keeping up of the ordinary stock of game. That is a burden on the right he acquires; and he must be bound by it just as if the landlord had, in the lease, reserved power to maintain a certain amount of oxen, or of young stock, on the farm. It is an implied part of the stipulation; and the rent is reckoned with reference to it. But then the landlord cannot turn the whole farm into a feeding-ground for his stock. Now, here there is no doubt that there has been a great and injurious increase of the game."—*Wemyss and Erskine's Trustees* v. *Wilson*, *2d December* 1847.—*Jurist*, vol. xx. p. 51.†

Landlord and Tenant.—Game.—Interdict against Tenant's Driving off Game.—Captain James Erskine Wemyss let to James Gulland the farm of Newton, in the county of Fife, for 25 years, from and after Martinmas 1839. The lease contained no express stipulation as to game. In January 1846 Captain Wemyss pre-

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* It appeared, that although the system of protection was in operation at the date of these leases, yet it had been only just commenced, and its consequences had not been ascertained.

† The question involved in this case was before the Court in the case of *Drysdale* v. *Jameson*, *30th November* 1832; and, although not then decided, similar principles were announced. See that case, *Jurist*, vol. v. p. 134. (11 Sh. 147,) and especially Lord Fullerton's note in reporting it to the Court.

sented a note of suspension and interdict in the Court of Session against Mr Gulland, stating that no alteration had been made in the system of preserving the game since the date of the lease, but that for some time back Mr Gulland had been in the practice, by himself and others employed by him, of hunting and driving the game off his farm, by means of muzzled dogs, and by discharging fire-arms, loaded with blank-cartridges, in the direction and close vicinity of the game upon the farm, for the purpose of alarming and driving off the game; that this had been habitually done during the close-time of the year 1845, and had proved highly injurious to the game, especially to hares with young, pheasants and partridges in their nests, and to young game generally; and that he further was in the practice of setting snares on the farm, under the pretence of snaring rabbits, but truly intended, or at least directly calculated to destroy game; and craving interdict against the continuance of all these practices. Mr Gulland admitted that he had resorted to these measures, and maintained his right to do so; alleging that the game had increased to an inordinate extent since the date of the lease, and denying that the rabbit-snares were intended or calculated to take game, or that any of the measures adopted by him had the effect of destroying game. The Lord Ordinary (Robertson) granted interim interdict; and thereafter, a record having been made up, his Lordship reported the cause to the Court (First Division) upon printed cases. The Court was unanimous in holding that a tenant was not authorised in taking the steps above mentioned, and pronounced the following interlocutor against Mr Gulland, with expenses:—"Interdict, prohibit, and discharge the respondent, by himself, or others employed by him, from hunting, pursuing, or scaring game on the farm of Newton, by means of muzzled dogs, or by discharging fire-arms, loaded with blank-cartridges; and likewise from entrapping, killing, or injuring game on the said farm, or the marches thereof, by means of snares set for the purpose of killing rabbits, but of a description, or in a manner, or in places truly calculated to entrap, injure, or destroy game, or without all due and usual precautions against injury to, or destruction of game."* —*Wemyss* v. *Gulland*, *3d December* 1847. *Jurist*, vol. xx., p. 55.

* The following observations from Lord Fullerton's delivered opinion will show the principle upon which this case was decided:—"Looking at the tenant's own statement of what he really does, it is impossible not to see that his operations are carried on for the positive purpose of completely extirpating the game. The tenant is not bound to take any active measures for keeping up the game, but he is not entitled to take active measures for destroying it." . . . "The question arises on the implied condition under the lease. What is the law and the practice? It is admitted that the tenant has no right to kill the game—that the lease does not imply any such right. On the other hand, it is clear that the object of this reservation in the lease is to give effect to the right of the landlord. He undoubtedly has the right to kill game. What, then, was the understanding of parties on entering into this contract? Simply that this right of killing by pursuit was reserved to the one party, and taken from the other: and on the very principle on which we went in the former case"—(see Wemyss,

Landlord and Tenant.—Subjects untenantable by reason of Nuisance.—George Kippen, writer in Glasgow, let a house in that city, for one year, to W. M. Oppenheim. Soon after the contract had been made, and before the day of entry, intimation was made to the landlord that the house was infested with clocks, or black beetles. Nothing was done to remedy this; and upon taking possession, the tenant discovered that these and other insects created a nuisance so excessive as to render the house uninhabitable, insomuch that his servant, who had slept two nights in the house, refused to remain. Whereupon, a few days after the term of entry, the tenant intimated the above state of the premises to the landlord, and that he gave up the house. The landlord retorted that the statements were false and injurious, and that unless he received an apology, he would institute an action of damages against him. The landlord further presented two petitions to the Sheriff of Lanarkshire, for the purpose of preventing the removal of Mr Oppenheim's effects from the premises, and compelling him to occupy the house during the period of the lease. These actions were conjoined; a proof was led which fully established the existence of the nuisance, and the Sheriff-Substitute assoilzied the tenant. The Sheriff, however, on appeal, held that the tenant was not entitled to throw up the lease without giving the landlord an opportunity of remedying the nuisance. On advocation, the Court, (Second Division,) adhering to the views of the Sheriff-Substitute and the Lord Ordinary, (Ivory), held that such opportunity had been given to a sufficient extent, and that the landlord had, by his actings and denial of the nuisance, refused to remedy it. They accordingly decerned for the tenant, with expenses.—*Oppenheim* v. *Kippen*, 14*th December* 1847. *Jurist*, vol. xx., p. 74.

Sale.—Coalfield.—Repetition in respect of Eviction of part of Subjects sold.—Robert Bald, Esq., purchased in 1832 a coalfield known as the "Woodlands' Coal," in the county of Clackmannan, being part of the sequestrated estate of the late Mr Crawford Tait of Harvieston, exposed at a public roup by Mr Tait's trustee. In the articles of roup the coalfield was stated to extend to "130 acres or thereby of undisputed property," and the trustee was taken bound to give to the purchaser a valid disposition containing a

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&c., v. Wilson, *supra*)—"we must here decide against the tenant. We must mete out the same measure of obligation to the tenant here as in the former case we meted to the landlord; and hold, on the fair construction of the contract, that the tenant is not entitled to take measures for the destruction of all the game on the farm. As to the distinction which is taken,—that the tenant is not prevented from chasing away the game,—that appears to me quite irrelevant. In construing a contract of this kind, the meaning of the reservation of the landlord's right is in reality that the game shall not be destroyed; and it is a mere mockery for the tenant to say, You are entitled to hunt and shoot, but I am entitled to take such measures as shall leave you nothing to hunt or shoot."

clause of absolute warrandice against Mr Tait's representatives and creditors, and to exhibit on all necessary occasions "a valid and sufficient progress of writs to the extent of a prescriptive title." The Globe Insurance Company had obtained, previous to this sale, an assignation to all Mr Tait's heritable debts; and the disposition to Mr Bald bore to be granted by their special advice and consent,—stated the price to have been paid to them,—contained a reference to the articles of roup,—and was signed by them as well as by the trustee. Mr Bald afterwards discovering that 26 acres of the coal-field sold to him were claimed by Mr Johnstone of Alva, raised an action against the Globe Insurance Company and Mr Tait's trustee, to compel them to exhibit a prescriptive title to the whole coalfield, or, failing their doing so, to pay such damages as might be found to be sustained in consequence of such failure. The defenders resisted this action by reference—1st, To the seventh article of roup, which declared "that no claim of abatement shall be competent" "for alleged deficiencies in the measurement," "or inaccuracies in the plan," "or otherwise relating to the exposer's right to the coal, the purchaser being understood to have satisfied himself of all these particulars previous to the roup;"—and 2d, To the clauses of warrandice and assignation of the titles in the disposition, which were in terms different from, and, it was argued, more limited than the articles of roup. The case being reported by the Lord Ordinary, (Ivory,) the Court, upon the 17th February 1841,* found the defenders bound to exhibit the titles called for. The defenders then produced certain titles; but these not proving satisfactory, the case was delayed until the question of property in the 26 acres was tried between Mr Johnstone and Mr Bald. An action having been brought for this purpose, the Court found Mr Johnstone's title good to exclude Mr Bald from the 26 acres in question.† The action between Mr Bald and the Globe Insurance Company and Mr Tait's trustee was then proceeded with; and the Court (Second Division) pronounced an interlocutor finding Mr Bald entitled to repetition from the Globe Insurance Company of such proportion of the price as might be proved to be a fair and proper division, in respect of the loss of the part of the coalfield now evicted by Mr Johnstone, and also to recover from Mr Tait's trustee so far as not paid by the Globe Insurance Company; and before answer as to the amount, &c., appointing Mr Bald to give in a claim.—*Bald* v. *Globe Insurance Company, and Scott, 17th December* 1847. *Jurist*, vol. xx., p. 99.‡

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* *Jurist*, vol. xiii. p. 253. (D. 3. 564.)

† 7th July 1847. (*Unreported.*)

‡ The legal grounds and arguments in the case have been omitted, as being too professional for a work of this nature, and the reader is referred to the original report in the *Jurist*.

Railways' Clauses Act.—Deviation of Parish Road.—Title to Oppose.—The Caledonian Railway Company having proceeded to deviate laterally the line of a certain parish road passing through the estate of Baberton in the county of Edinburgh, Archibald Christie, Esq., the proprietor of Baberton, applied for an interdict against the completion of the proposed deviation, and the shutting up of the original line of road. The proposed deviation was neither laid down in the Parliamentary plans and sections, nor specially authorised by the Company's act. The question, therefore, turned upon the general powers given by the Railways' Clauses Consolidation (*Scotland*) Act, (8 & 9 Vict. c. 33.)* It was admitted that if the lateral deviation was not adopted, the original road must, to permit the formation and use of the Railway, be altered *vertically* to the extent of 11 or 12 feet. The Road Trustees had been scheduled as the proprietors of this road, and they did not join in the present application. The Lord Ordinary (Jeffrey) refused the Note, but without expenses, and the Court (2d Divison) adhered; some of their Lordships expressing a doubt whether the title to make such an application was not limited to the Road Trustees.—*Christie* v. *Caledonian Railway Company*, 18*th December* 1847. *Jurist*, vol. xx., p. 106.

Arrestment.—Contract.—On the 9th December 1843, James Cooper entered into a contract with the late Captain Boswall of Wardie, in the county of Edinburgh, to cover the roof of a house with slates, at a certain price per rood, to be paid when the whole was completed and measured. Upon the 12th February 1844, James Nimmo & Co. used arrestment in the hands of Captain Boswall on dependence of an action raised by them against Cooper, there being at this time on Captain Boswall's premises slates of the value of L.13, 1s. 4d. laid down by Cooper. The work being completed and measured in April 1844, the sum of L.26 was found to be due under the contract; and this sum being still unpaid in October 1844, James Marshall used arrestment in Captain Boswall's hands, on a bill granted by Cooper for L.18, 15s., which had been dishonoured and protested. In these circumstances Captain Boswall raised a multiplepoinding in the Sheriff-Court of Edinburgh, in order to ascertain which party was entitled to the money. The question came to be whether the arrestment of

* The 49th clause of this act provides that "If the road so interfered with can be restored compatibly with the formation and use of the railway, the same shall be restored to as good a condition as the same was in at the time when the same was first interfered with by the company, or as near thereto as may be ; and if such road cannot be restored compatibly with the formation and use of the railway, the company shall cause the new or substituted road, or some other sufficient substituted road, to be put into a permanently substantial condition, equally convenient as the former road, or as near thereto as circumstances will allow."

Nimmo & Co., on the 12th February, attached the whole su to become due on the completion of the contract, or only t slates on the ground at the date of the arrestment. The Shei and the Sheriff-Substitute pronounced opposite judgments, a the cause having been advocated, the Lord Ordinary (Robertso reported it to the Court. The Court (2d Division) held tl Nimmo & Co.'s arrestment covered the whole sum due.—*Mc shall* v. *Nimmo & Co.*, 8*th December* 1847. *Jurist*, vol. x: p. 112.

Sale of Farm Stock.—Quinquennial Prescription.—Statute 16(c. 9.—David Campbell brought an action against Charles Griers for £15, 8s. 9d., the price of two lots of corn and a horse, sold Grierson in 1838. Grierson pleaded prescription under the A 1669, c. 9,* as the claim had not been made till the year 1845; also stated that he had made the purchase on behalf of Campbe landlord, for whom he was factor, and to whom Campbell was that time indebted in a half-year's rent, amounting to £25, 4s. 9 and thereupon pleaded compensation. Campbell argued that t latter statement was an admission of the bargain, and that, the fore, the statute did not apply. But the Lord Ordinary (Ivoi found, that the action not having been raised within the statutc period, the grounds of the action were proveable only by writ oath of party; that the action was laid upon an allegation tl the defender purchased the articles on his own account; that, the contrary, the defender, while he admitted having purchased t articles, expressly averred that he did so on account of, and representing, the landlord; that this, so far from supporting t alleged ground of action, was a substantial denial of it; and Lordship therefore sustained the plea of prescription, and, respect that the pursuer had not proved his case *scripto vel ju: mento*, assoilzied the defender with expenses. Campbell reclain against this interlocutor, and the Court (Second Division) una mously adhered.—*Campbell* v. *Grierson*, 15*th January* 1848. *J rist*, vol. xx., p. 124.

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* This statute declares "that all bargains concerning moveables, or sums of mo: probable by witnesses, shall only be probable by writ or oath of party, if the sa be not pursued for within five years after the making of the bargain."

TABLE OF PRICES, &c.

The Average Price of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1847.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 4.	53 2	32 2	23 10	36 0	48 11	41 5
11.	53 5	32 0	24 5	35 2	47 8	39 11
18.	53 3	32 10	22 4	33 1	55 8	38 9
25.	57 0	33 9	21 0	34 0	46 1	38 2
1848.						
Jan. 1.	57 1	33 9	21 9	34 2	46 2	36 2
8.	56 10	32 11	22 2	34 6	51 0	37 11
15.	56 6	31 1	23 2	33 6	49 3	37 0
22.	55 10	31 5	23 2	33 0	48 4	35 7
29.	54 8	31 2	24 10	32 8	45 7	35 6

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1847.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 1.	52 10	30 11	23 8	36 6	36 0
8.	56 4	31 11	23 7	36 3	35 6
15.	54 10	32 5	23 9	35 6	35 0
22.	55 1	32 4	24 2	34 1	33 6
29.	54 7	31 2	24 7	33 9	33 2
1848.					
Jan. 5.	53 5	30 9	24 9	34 6	34 0
12.	54 3	31 5	24 7	35 5	35 0
19.	53 5	31 9	24 9	36 6	35 6
26.	52 9	32 9	24 5	35 2	34 0

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1847.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 4.	51 11	32 6	23 10	32 7	50 4	44 2
11.	52 11	32 8	23 8	33 4	48 2	47 0
18.	53 7	33 3	21 11	34 6	47 6	40 11
25.	54 6	31 10	24 10	33 4	45 6	42 6
1848.						
Jan. 1.	54 7	31 8	24 2	31 9	46 9	42 0
8.	55 10	32 4	22 11	33 6	46 2	39 6
15.	55 1	33 4	22 3	36 4	46 6	43 1
22.	53 7	33 2	21 9	34 8	54 8	41 10
29.	52 5	30 9	21 2	33 6	50 4	38 9

DUBLIN.

Date.	Wheat.	Barley.	Rice.	Oats.	Flour.
1847.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 3.	30 6	16 6	13 6	12 6	17 6
10.	27 7	15 11	14 0	11 8	16 8
17.	29 1	16 3	13 11	12 2	16 6
24.	28 9	16 1	14 2	12 4	16 4
31.	30 3	15 4	13 9	12 6	16 6
1848.					
Jan. 7.	29 2	15 3	12 10	12 1	17 0
14.	29 4	16 11	13 3	11 8	17 2
21.	29 0	16 8	13 1	11 6	16 10
28.	27 11	15 10	13 5	11 3	16 4

TABLE showing the Weekly Average Price of GRAIN, made up in terms of 7th and 8th Geo. IV., c. 58, and 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties payable on FOREIGN CORN: the Duties payable thereon, from December 1847 to February 1848.

Date.	Wheat.			Barley.			Oats.			Rye.			Pease.			Beans.		
	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.
1847.	s. d.	s. d.	Free.	s. d.	s. d.	Free.	s. d.	s. d.	Free.	s. d.	s. d.	Free.	s. d.	s. d.	Free.	s. d.	s. d.	Free.
Dec. 4.	52 1	53 2	..	30 8	32 2	..	22 5	22 11	..	28 11	32 7	..	49 7	49 3	..	44 0	45 5	..
11.	51 11	52 10	..	30 5	31 8	..	22 4	22 10	..	31 0	32 3	..	47 7	48 8	..	42 7	44 10	..
18.	52 2	52 10	..	30 7	31 3	..	21 7	22 7	..	34 4	33 0	..	48 2	48 6	..	41 6	44 0	..
25.	53 11	52 8	..	31 8	31 0	..	20 7	21 10	..	29 11	31 4	..	44 10	47 2	..	39 10	42 2	..
1848.			..															
Jan. 1.	53 6	52 6	..	31 6	30 10	..	20 6	20 8	..	30 1	31 6	..	45 1	47 4	..	40 2	42 6	..
8.	53 10	52 10	..	31 7	31 0	..	20 11	21 6	..	31 4	31 1	..	46 0	46 9	..	40 8	41 6	..
15.	53 5	53 1	..	30 6	31 0	..	21 0	21 3	..	29 2	31 2	..	46 4	46 3	..	39 1	40 8	..
22.	53 1	53 3	..	30 4	31 2	..	21 1	21 2	..	30 8	31 1	..	45 2	45 10	..	38 8	40 1	..
29.	52 0	53 2	..	30 8	31 0	..	21 3	21 0	..	30 6	30 5	..	43 5	45 0	..	38 7	39 7	..

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Date.	Markets.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1847. Dec.	Danzig	43 to	50	22 6	30	15 6	20	22	30	30 6	38	28	36
1848. Jan.	—	42	48	25	31	16	21 6	24	31	30	36]	28 6	35
1847. Dec.	Hamburg	43	51	21 6	32	14	17 6	20	24	30 6	38	30	36
1848. Jan.	—	40	48	20 6	30	14	17	21	25	32	40	31 6	38
1847. Dec.	Bremen	42	50 6	25	32 6	13 6	18	23	29	30 6	38	30 6	36
1848. Jan.	—	40	48	22	30	14	18 6	22	28 6	30	36	32	38
1847. Dec.	Konigsberg	36 6	46	20 6	30	14 6	18	23 6	29	28 9	36	30	38 6
1848. Jan.	—	38 6	48	20	31	15	20	22	28 6	29	35	32	40

Freights from the Baltic, 3s. 6d. to 6s. 6d.; Mediterranean, 7s. to 10s.

THE REVENUE.

5th January 1847—5th January 1848.

	Quarters ending January 5.		Increase.	Decrease.	Years ending January 5.		Increase.	Decrease.
	1847.	1848.			1847.	1848.		
	£	£	£	£	£	£	£	£
Customs......	4,514,721	4,111,862	..	402,859	18,310,865	18,015,298	..	295,567
Excise........	3,608,155	2,246,883	..	361,272	12,521,250	11,730,764	..	790,504
Stamps	1,740,687	1,564,855	..	175,832	6,931,414	6,959,546	28,132	..
Taxes........	1,909,899	1,914,783	4,884	..	4,272,408	4,334,561	62,153	..
Post-Office....	403,000	208,000	5,000	..	816,000	864,000	48,000	..
Miscellaneous	59,657	51,746	..	7,911	437,090	261,926	..	175,164
Property Tax	450,219	462,567	12,848	..	5,395,391	5,450,801	55,410	..
	12,486,338	10,560,496	22,732	947,874	48,684,418	47,616,896	193,695	1,261,235
	Deduct Increase			22,732	Deduct increase			193,695
	Decrease on the qr.			925,142	Decrease on the year			1,067,540

TABLES OF BUTCHER-MEAT.

Date.	LONDON. Per Stone of 14 lbs.		LIVERPOOL. Per Stone of 14 lbs.		NEWCASTLE. Per Stone of 14 lbs.		EDINBURGH. Per Stone of 14 lbs.		GLASGOW Per Stone of 14	
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mu
1847.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d.
Dec.	7 6 to 8 6	8 3 to 9	7 6 to 8	7 6 to 8 6	7 to 8 3	7 3 to 8 6	7 to 8	7 3 8 3	7 3 to 8 6	7 3
1848. Jan.	7 3 8 3	8 8 6	7 8	7 3 8 3	7 7 9	7 8	6 9 7 9	7 8	7 8	7

PRICES of English and Scotch WOOL.

English, per 14 lbs.

	s. d.		s. d.
Merino,	11 6	to	14 6
in grease,	9		11 6
South Down,	13		16
Half-Bred,	10		14 6
Leicester Hogg,	9 6		13 6
Ewe and Hogg,	7		11
Locks,	5 6		7
Moor,	4 6		6

Scotch, per 14 lbs.

	s. d.		s. d.
Leicester Hogg,	11	to	14
Ewe and Hogg,	8		12 6
Cheviot, white,	7 3		10 6
Laid, washed,	5 3		8 3
unwashed,	4 3		7 3
Moor, white,	5		7
Laid, washed,	4		5 3
unwashed,	3		4 6

THE USE OF LIME IN AGRICULTURE.

No. III.

By Professor Johnston.

Section I.—*Is Lime indispensable to the fertility of a Soil?*

The practical farmer in nearly all countries has been accustomed to add lime to the soil; but can lime not be dispensed with? Is there no improved mode of culture by which the use of lime may be superseded? There are several considerations from which an answer may be drawn to this question.

1°. Extensive and prolonged experience has shown that the fertility of many soils is increased by the regular addition of lime—that the surface of whole districts even is sometimes doubled or tripled in value by the addition of lime alone—and that, if it be for a series of years withheld, such soils become incapable of producing luxuriant crops.

2°. All naturally fertile soils are found upon analysis to contain a notable proportion of lime; while in many of those which are naturally unproductive, the proportion of lime is comparatively small.

3°. A naturally productive soil, even though regularly manured, is often found, after long cropping, to become incapable of growing particular crops in an abundant or healthy manner. On analysis, these soils are not unfrequently found to contain only a very small proportion of lime. After an addition of lime to such soils, the diseased or failing crops often grow again healthily and in abundance.

4°. Lime added to one part of a farm sometimes produces no visible effect, while upon another it greatly increases the produce. In such cases, a chemical analysis not unfrequently shows, that those soils or fields on which it produces no effect already contain a sufficient supply of lime, and in the state most favourable to fertility.

Thus barren sandy soils often admit of profitable cultivation after lime has been added; and clay soils, in which little or no lime can be detected, are often entirely changed by the addition of lime. So, also, it may usually be laid with profit upon soils formed from decaying granite, while its action is frequently less sensible when applied to soils of decayed trap. This is chiefly because the granite contains little lime naturally, while the trap-rocks for the most part abound with it.

These practical considerations all lead to the conclusion, that *lime is really indispensable to the fertility of the soil.*

5°. This conclusion, drawn from experience, is rendered certain by the fact, that all the crops we raise contain lime, which they derive solely from the soil. To this fact I shall hereafter more particularly advert, when treating of the purposes served by lime in the soil.

SECTION II.—*What quantity of Lime may or ought to be present in the Soil?*

It is an exceedingly difficult point to determine the limits within which the proportion of lime in a soil ought to be kept, in order to maintain the highest degree of fertility. So much depends upon the proportions of the other ingredients of the soil—upon the quantity of sand, of clay, or of vegetable matter it contains—that the peculiar nature, both chemical and mechanical, of almost every soil would require to be studied in order to know how much lime it ought to contain, or how much may be safely added to it with the hope of a profitable return. Sandy and peaty soils, when dry, require less than such as are naturally heavy or undrained.

We know that the limits are really very wide within which the proportion of lime in the land may be kept without preventing it from growing good crops; but there are three questions in regard to these limits, to which the practical man is interested in obtaining satisfactory answers:—how *much* may be present in the soil, or how *little*, without rendering it unproductive? and what proportion *ought* to be present, in order to make it fertile in the highest degree?

1°. *How* MUCH *may be present?*—I have alluded, in a previous article upon this subject, to the practice of deep ploughing in the chalk soils of Surrey and the neighbouring counties. When from five to seven inches of pure chalk are brought up, and mixed with an upper soil only six inches deep, it is obvious that the quantity of carbonate of lime in the mixed soil must be very great. And since these soils so deepened become, under skilful management, more productive than before, it is obvious that the presence of a very large proportion of carbonate of lime will not alone prevent any soil from yielding good crops.

Through the kindness of Mr Hewitt Davis, in sending me a portion of the surface soil of such an improved chalk-field near Croydon, I have been enabled to analyse it, and have found it to contain 41 per cent of carbonate of lime in the form of crumbled chalk.

The natural soil of the plains of Athens, analysed in my laboratory, contains also nearly as much lime, as appears from the following statement of its composition:—

SOIL FROM THE PLAINS OF ATHENS.

Organic matter	5·75
Salts, soluble in water (common salt and sulphate of soda)	0·20
Sulphate of lime (gypsum)	0·18
Oxides of iron	2·91
Alumina (soluble in acids)	2·35
Carbonate of lime (finely divided limestone)	38·08
Carbonate of magnesia	0·73
Phosphate of lime	0·033
Insoluble siliceous matter	50·33
	100·563

This soil *produces excellent crops of wheat*, but is liable, when the dry season comes, to be covered over with a crust of saline matter, which prevents it from growing grass. It contains very nearly as much lime as the chalk soil of Mr Hewitt Davis. We conclude, therefore, that as much as two-fifths of the whole soil may consist of carbonate of lime, without its being by this cause rendered unproductive.

2°. *How* LITTLE *may be present?*—It is more difficult to say how little lime may be present without materially affecting the fertility of the soil. The nature of the surface and under soil of a field, the circumstances in which the field is placed, and the kind of cropping to which it is subjected, all materially affect this question.

a. Thus, if the upper soil abound in vegetable matter, the proportion of lime cannot be diminished to so great a degree without affecting its fertility—while, if the under soil abound in lime, so large a proportion may not be absolutely necessary in the surface.

b. The circumstances in which the field is placed will influence the proportion of lime that is absolutely necessary. Thus, if springs arise in it, the waters of which contain lime—or if waters impregnated with lime flow from the adjacent rocks or hills, as is the case where marl beds are formed—or if the yearly rains wash down into it from the higher grounds the lime which they contain—these circumstances may give such a constant supply of lime to the land as to render unnecessary the permanent presence of a large proportion in the soil of the field itself. It is necessary that the effect of such local circumstances should be, in all cases, taken into account; otherwise analysis might sometimes lead us to suppose, and no doubt has led some to suppose, that a much smaller proportion of lime may be present, without injury to the soil, than is really required, where no such supplies are naturally brought into it, to keep it in an average state of fertility.

Thus Sprengel found, upon analysis, that the rich marsh lands of Holstein and East Friesland contained only a minute proportion of carbonate of lime; the

Marsh lands of Holstein only . .	0·2 or one-fifth per cent.
The salt marshes of East Friesland .	0·6 or three-fifths per cent.

But we should be wrong were we to conclude that, because these lands bore rich and fattening pastures, therefore this small proportion of lime is sufficient to make every land bear good grass. The floodings to which these lands are subject, or the supplies of water that are constantly brought into them from beneath, no doubt contribute, in a considerable degree, to the permanent richness of the grass they bear.

It appears, however, from these analyses, that, under certain circumstances, a very small proportion indeed may be sufficient to keep the land in a state of permanent fertility.

c. But something also depends upon the kind of crops we wish or continue to grow. It is possible that grass land kept in pasture may require less lime than arable lands; because the roots of the grasses are small, branch out in every direction so as to come into contact with a large proportion of the soil, and remain in the land the whole year through, collecting their food from the soil. In the soil of a field of old grass land in the neighbourhood of Durham, I found only 1·3 per cent of carbonate of lime; and numerous soils from the dairy county of Chester have given me considerably less than 1 per cent.

Yet when such land is ploughed up, though it may give one or more good crops by the aid of the decaying vegetable matter of the turf, it will soon refuse to grow healthy crops of corn or oats, and will certainly not yield large green crops, unless lime be added in greater or less proportion.

I have already alluded to the fact, that crops become diseased—grow up, perhaps, well at first, but afterwards assume a sickly appearance, or fail altogether—when the proportion of lime in a soil becomes very small. This is true of every kind of soil in almost every part of the world, and in reference to almost every crop. The first of the following soils was sent to me with the statement that for four rotations the turnips had come up well, but in the autumn had always become diseased, rotted and failed, and a remedy was asked; on the second, barley came up well, but afterwards failed; on the third, from Jamaica, plantains refused to grow:—

	Pinkie, near Edinburgh.	Lynedoch, Perthshire. Soil.	Lynedoch, Perthshire. Subsoil.	Jamaica.
Organic matter	6·69	10·03	2·05	9·59
Salts soluble in water	1·07	trace	trace	1·16
Oxides of iron	6·91	3·02	5·12	3·21
Alumina		2·56	2·23	1·16
Sulphate of Lime	...	0·44	0·14	...
Carbonate of Lime	0·31	0·30	0·37	0·38
Carbonate of magnesia	trace	trace	trace	trace
Oxide of manganese	0·24	...	...	0·07
Siliceous matter	84·58	83·37	88·20	84·31
	99·80	99·72	98·11	99·88

In all these soils, and especially in the first and third, the proportion of lime in any state of combination is very small; and though each case required other special remedies also, I recommended, among the measures to be taken with the view of rendering them productive, the addition of lime in one form or another to them all.

I consider, therefore, that these soils contained less than arable land, which derives no supply from any natural source, *ought* to contain, if it is to produce healthy and abundant crops.

3°. *How much* OUGHT *to be present?* To maintain a soil in the highest state of fertility, it need not contain so much as was found in the chalk and Athenian soils above described, nor should there

be so little in it as was present in those from Pinkie, Lynedoch, and Jamaica. Those soils which are naturally most fertile in regard to *all* our cultivated crops, usually contain a considerably larger quantity than was present in these latter soils,—while those which naturally contain so small a proportion are almost universally improved by an addition of lime. Still, scarcely any proportion can be stated which will be really the most advantageous for any considerable number of different soils. As a matter of opinion, however, I may state that I believe there are few soils in our climate to which lime, in the proportion of, or in quantity equal to, three per cent of the carbonate will be too much; while, on the other hand, there are not many in which it will be of advantage to increase the proportion of carbonate beyond from six to ten per cent, *provided this carbonate be in a sufficiently minute state of division.*

So much, however, as I have already said, depends upon the nature of the soil—its locality, its stiffness, the state of drainage, the proportion of vegetable matter and of salts of iron it contains, and upon the states both of chemical combination and of mechanical division in which the lime exists in the soil—that I should consider it necessary to inquire into all these circumstances in each special case, before I ventured to give a decided opinion as to the amount of expenditure of lime and money for which a profitable return was likely to be obtained.

SECTION III.—*States of Chemical Combination in which Lime is known to exist in the Soil.*

This lime, which, in certain proportions, is so indispensable to the fertility of the soil, may exist in it, however, in various states of chemical combination.

1°. *In the state of carbonate.*—In most of the soils which occur in chalk and limestone districts, and in those to which lime or marl has been largely or regularly added, a considerable proportion of the lime exists in the state of carbonate. The presence of this carbonate is readily detected, either by the appearance of white specks in the soil when examined by the aid of the microscope, or by the bubbles of gas which may be seen to arise from it when vinegar or diluted muriatic acid is poured upon it. By slow degrees, however, this carbonate becomes converted in the soil into one or other of the compounds about to be described.

2°. *In the state of bi-carbonate.*—During the decay of the vegetable matter of the soil, carbonic acid is formed. This is partly absorbed by the water which rests in or which passes through the soil; and the water thus charged with carbonic acid dissolves, time after time, small quantities of the carbonate of lime which the soil contains, and holds it in solution as *bi*-carbonate. In this state of bi-carbonate it partly enters into the roots of plants, and supplies

the lime which they require for their healthy growth, and is partly carried away into the drains, or other natural outlets by which the excess of water usually escapes from the land.

3°. *In the state of sulphate of lime, or gypsum*, it exists in minute quantity in nearly all soils. Its presence may be detected by boiling a portion of the soil in water, allowing the water to stand till it becomes clear, and then evaporating or boiling down the liquid nearly to dryness. Minute white or brownish crystals of gypsum will then form, if any very sensible quantity be present in the soil.*

Gypsum is not known—like the carbonate of lime in our chalk soils, or in that of Athens, of which the analysis is given above—ever to form a large proportion of any fertile soil; and it is doubtful, therefore, whether, if it were present in any case in *very* large proportion, the soil would be likely to produce good crops.

There are many soils, however, in which nearly all the lime they contain is present in the state of sulphate. Such was the case with the following soils from Ayrshire, which were analysed in my laboratory. They came from the farm of Mr Campbell of Craigie, near Ayr:—

SOILS FROM CRAIGIE.

	1.	2.	3.	4.
Organic matter	6·75	9·72	7·17	3·58
Gypsum (sulphate of lime)	0·50	0.64	1·30	0·70
Oxides of iron	2·60	2·42	5·58	3·52
Alumina (soluble)	1·72	0·61	0·95	1·13
Phosphoric acid	trace	trace	0·13	0·08
Carbonate of lime	...	...	...	...
Carbonate of magnesia	trace	trace	trace	trace
Oxide of manganese	0·49	0·22	0·88	0·19
Insoluble matter*	87·30	86·09	83·96	90·09
	99·36	99·70	99·47	99·29

In this state of sulphate, lime is incapable of performing many of those useful purposes which, as usually applied to the land, it is fitted to perform. When all the lime is in this state of sulphate, an unhealthy condition of the soil is often indicated—the existence, namely, or natural production of too large a proportion of sulphuric acid. This production of sulphuric acid takes place more constantly and more extensively in the soils of certain geological formations; and its evil consequences can be most economically guarded against by the practical man by the

* It may be detected with less trouble by taking two separate portions of the water, and dropping into one a solution of chloride of baryum, which will give a white cloud if sulphuric acid be present, and into the other a solution of oxalate of lime, which will give a white cloud, or a slight milkiness, after a time, if lime be present. But this method requires the possession of substances not usually in the hands of practical men.

insertion of drains, and by the frequent application of moderate doses of chalk, burned lime, or marl.

I need scarcely add that, where this sulphate already exists in the soil, or where there is a tendency to produce it, less profit is to be expected from the use of gypsum, either alone as a top-dressing, or when applied along with the manure. All other experiments made upon it also will be more or less modified by the state as well as by the proportion of the lime which exists in it.

4°. *In the state of phosphate*, lime occurs very sparingly in the soil, though there are probably few fertile soils in which it is wholly wanting in this state of combination. In such as have been repeatedly dressed with bones, it may be looked for in larger proportion; and in such as have not been exhausted by repeated crops of corn, or by the long-continued practice of rearing young stock. Still, even in an unexhausted or well-boned soil, it may be contained in too small a proportion to be capable of being estimated in the quantity of soil usually employed in making an analysis. The determination of this ingredient of a soil, therefore, requires great dexterity and much skill in chemical manipulation, and can only be performed by an instructed chemist.

One mode of detecting it is to digest 500 or 1000 grains of the dry soil in dilute muriatic acid for twelve hours by a gentle heat, to filter and add ammonia (hartshorn), when a reddish brown precipitate will fall. If this precipitate be collected, and vinegar be poured upon it, the whole will dissolve, if no phosphoric acid be present. If any thing remains undissolved, it is phosphate of iron; and from its weight, when collected, the quantity of phosphoric acid, and consequently that of the *phosphate of lime*,* in the soil may be calculated.

A more trustworthy method, however, is to dissolve in muriatic acid the precipitate thrown down by ammonia, and to add tartaric acid to the solution, and then ammoniacal sulphate of magnesia, when the phosphoric acid will fall in the state of ammoniacal phosphate of magnesia.

5°. *In the state of silicate*, the quantity of lime contained in the soil is variable, but usually small. In stiff clays, the silicate of lime generally forms part of the insoluble portion which remains behind after they have been digested in muriatic acid; and it is often present in the stones and decaying portions of rock which are mingled with nearly all soils. It is especially abundant in fragments of the trap-rocks, and those of the older slates usually contain it in appreciable quantity. Thus the per-centage of lime in the state of silicate contained in a stiff clay from Derbyshire, in fragments of clay

* The chemical reader will understand that the phosphoric acid *may* be combined with the oxide of iron in the soil, and not with the lime. Into this point I do not here enter, as in very many cases it must remain a mere matter of opinion with what substance this acid is combined when it is present in the soil.

slate from a soil near Wigton, and in portions of trap from a soil near Edinburgh, was as follows:—

	Lime in the state of silicate.
Stiff clay	1·1 per cent.
Decaying slate	0·96 ...
Decaying trap	2.9 ...

When present in the soil in this state, it is only dissolved in part, often in very small part, by digesting the soil in acids. It will often, therefore, escape the notice of the chemist by whom the insoluble part is neglected. And yet, if we compare the quantities above given with the whole quantity of lime found in many soils, as stated in Section II., we shall be satisfied that the proportion which is present in the state of silicate must often form an important part of the whole lime which a soil contains. And as the proportion of lime, and the state in which it is present, are points which ought both to be considered in forming an opinion in regard to the agricultural capabilities of almost every soil—the improvement of which it is susceptible, and the way in which that improvement is to be effected—it must often be of consequence that the quantity of lime in the insoluble part should be accurately ascertained. This, however, involves more time and labour, and a higher chemistry, than the expense which most people are willing to incur, in order to obtain an analysis, will permit the skilful analytical chemist to bestow upon it.

The importance of attending to this insoluble part is remarkably illustrated by the following analysis of a virgin soil, from the site of a portion of the old Caledonian Forest, lately cleared and trenched to a depth of three feet, by Mr Burnet of Gadgirth, near Ayr. The portion analysed was taken from a depth of 12 inches:—

SOIL OF THE CALEDONIAN FOREST AT GADGIRTH.

Organic matter	5·29
Salts of potash and soda	0·43
Gypsum	trace
Carbonate of lime	trace
Lime (in the state of silicate)	4·15
Carbonate of magnesia	0·51
Oxide of iron	5·81
Alumina soluble in acids	2·05
Alumina in the state of silicate	11·12
Phosphoric acid	0·02
Silica	69·16
	98·54

This soil, analysed in the ordinary way by the action of acids, gave scarcely a trace of lime either in the state of carbonate or of sulphate (gypsum,) and yet it contained no less than 4 per cent in the state of silicate.

This silicate of lime undergoes a gradual decomposition in the soil, and the lime becomes converted chiefly into carbonate, in which

state it is more directly available for the purposes of vegetation. It is by the action of the carbonic acid contained in the air and in the soil that this change is brought about; and the decomposition thus effected is supposed to be one of the good results which follow from the prolonged exposure of the soil to the action of the air, where the practice of naked fallows prevails, or where trenching is found to be profitable.

6°. *In the state of nitrate.* All our rich soils contain more or less of nitrate of lime. It is very valuable to the plant, and is most abundantly formed where lime, common salt, and organic matter are mixed together, as in a compost heap.

7°. *In the state of chloride of calcium,** lime exists in minute proportion in very many soils. In this form it is very soluble in water, and may, therefore, be extracted by boiling a few hundred grains of the soil in half a pint of water, and afterwards evaporating the filtered solution. It rarely happens, however, that one pound of this chloride exists in a thousand pounds of soil. Yet, by the agency of natural causes, it is continually produced in minute quantities in soils which contain much lime in other states of combination; and, from its great solubility, it is a form in which lime readily finds its way into the roots of plants.

8°. *In the state of humate and ulmate,* lime exists in many soils; but as it is necessary to explain what is meant by the humic and ulmic acids, I shall treat of these combinations of lime in a separate section.

SECTION IV.—*Of the Humic and Ulmic Acids, and the Humate and Ulmate of Lime.*

1°. If the common soda, or the pearl ash of the shops, be dissolved in water, and boiled upon a quantity of peat broken into small pieces, a dark brown solution will be obtained. If this solution be allowed to settle, and vinegar or diluted muriatic acid (spirit of salt) be then added to it, a brown powder will fall to the bottom. This brown powder consists of humic, with a variable admixture of ulmic acid.

If, instead of peat or peaty soil, the ordinary soil of any of our

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* This name, *chloride of calcium*, requires explanation.

a. Lime consists of oxygen and a metal called *calcium*.

b. Chlorine is a greenish yellow gas, the colour and smell of which are perceived when a little dry chloride of lime is put into a wine glass, and sulphuric acid (oil of vitriol) is poured upon it.

c. Chloride of calcium consists of the metal, calcium, in combination with this gas, chlorine. If chlorine, therefore, take the place of the oxygen in lime, chloride of calcium is produced.

d. Soda consists of oxygen and a metal, *sodium*.

e. Common salt consists of chlorine and the same metal. It is, therefore, called *chloride of sodium*. If its chlorine be exchanged for oxygen, soda will be produced.

Lime and common salt in the soil often mutually exchange their oxygen and chlorine, forming soda and chloride of calcium. The same takes place also to some extent when quicklime is mixed with salt, or is slaked with sea-water.

fertile fields be taken, the same dark brown solution and dark bro powder will be obtained, though in smaller proportion. The larg the proportion of vegetable matter in the soil, the larger, also, general, will be the quantity of these acids which a given weight the soil will yield.

2°. The humic and ulmic acids, and certain other acid substanc are always produced in greater or less quantity during the dec of vegetable matter in the soil. If any substances be present w which they can combine—such as potash, soda, lime, or magne —they unite with them, and form chemical compounds. But as in a mass of peat, such substances are not naturally present sufficient quantity, those acids accumulate in an uncombined sta and form a sour soil, into which the roots of our cultivated cr cannot safely descend.

3°. When marl or quick-lime is added to a soil in which th acids exist, or in which they are gradually produced, the li unites with the acids, and forms humate and ulmate of lin Hence, we should expect that a portion of the lime in most so and especially in such as abound in vegetable matter, should ex in them in the state of humate or ulmate; and such, upon analy is found to be the case.

Few soils have yet been examined with the view of determini how much of the lime they contain is present in this state of hum or ulmate of lime. In some, as in pure, and especially in w peaty soils, we may expect the whole of the lime, soon after it l been applied to them, to be converted into these compounds; wh in others, a portion of it may long remain in the state of carbona Those soils which contain lime in the state of carbonate will eff vesce when diluted muriatic acid (spirit of salt) is poured up them; those which contain only humate will not effervesce, thou the acid will dissolve out all the lime.

4°. It is thought by some, erroneously I believe, that the fertil of a soil depends very much upon the quantity of lime it conta in the state of humate. Thus it is stated by M. Dubuc that cert soils in Normandy are very rich in humate of lime, and that th soils also yield the best return of wheat. For example, the soils of

Locality of soils.	Contain per cent of Carbonate.	Humate.	And yield of wheat
Lieuvin, Neubourg, and Sistot	—	18 to 20	12 to 15 fol
Pavilli	—	5	8 to 10
Bieville	24	—	8 to 10
Clay of Ouche	—	1	4 to 5

But the large returns yielded by the former two soils are not be ascribed to the *humate alone*, but among others to the circu stance that while lime and organic matter in the form of hum acid abound in the soil, it is rich enough also in all the other su stances which are necessary to the growth of plants.

This much, however, is to be confessed—that the soil mig

contain all these other things, and yet be unable to bear good crops were this humic acid present in an uncombined state. The addition or presence of lime, by giving rise to the production of humate of lime, not only prevents the injurious action of this acid upon the roots of plants, but improves also the physical condition of the soil —rendering it less retentive of water, more friable, more open, and more permeable to the air, to water, and to the roots of the growing crops. This is one of the causes of the known good effects which follow from the addition of lime to peaty and other soils that are rich in vegetable matter.

Lime *exists* in the soil in greater or less proportion in all the states of combination described in the present and preceding sections. In the state of quicklime, however, and of carbonate, it is most largely and most extensively *applied* to the land. In what quantity ought lime in those two forms to be applied to our cultivated fields?

SECTION V.—*Theoretical Quantity of Lime which ought to be added to the Soil.*

Theory affords us no certain guide as to the quantity of lime which ought to be added to the land; but suppose the soil to be absolutely destitute of lime, then there are several considerations to which it is of importance for the practical man to advert.

1°. The crops which are reaped from an imperial acre of land carry off every year, as part of their substance, as much lime as is nearly equal to *one bushel* of lime-shells. So much, therefore, must be added every year to replace what the crops carry off.

But if it is considered that the roots of our corn crops come in contact with only a very small proportion of the soil—not, perhaps, more than one-hundredth of the whole—and that they can draw food only from that part with which they actually come in contact, it will appear that a very much larger quantity of lime ought to be present in the soil than is merely required by the crop we happen to grow.

Further than this, however, theory cannot go. It cannot fix any absolute quantity which it will be most proper or profitable as a general rule to apply. In fact, as we shall hereafter see, so much must depend upon circumstances that no absolute quantity can ever be ascertained, either by theory or by experience, which will apply to all land or to land in all conditions.

2°. In order *to add one per cent* of lime to the land, the quantity to be laid on will depend upon the depth. The following table shows the number of tons of burned lime, as it comes from the kiln, which will give one per cent of lime to soils respectively three, six, nine, and twelve inches in depth:—

	If the depth of the soil be			
Tons of burned lime.*	12 in. *per cent.*	9 in. *per cent.*	6 in. *per cent.*	3 in. *per cent.*
16 tons give . . .	1	1½	2	4
12 tons give . . .	¾	1	1½	3
8 tons give . . .	½	¾	1	2
4 tons give . . .	¼	⅜	½	1

The same weights of dry chalk, or of shell-sand, or limestone gravel, or crushed limestone—if unmixed with siliceous or other matter—will add a per-centage of *carbonate* of lime represented by the numbers in the above columns. It must be borne in mind, however, that a ton of this carbonate contains only 11¼ cwts. of well-burned lime.

3°. If—as I have stated in a preceding section, as a mere opinion founded upon the results of analyses—three per cent of lime, at least, ought in our climate to be present in a soil which contains an ordinary proportion of vegetable matter and of the other food of plants, then, according to the preceding table, we ought to add to a soil *which is entirely destitute of lime* as much as—

Of quick-lime.			
48 tons	when the soil is	12	inches deep.
36	....	9	......
24	....	6	......
12†	....	3	......

These are very large doses; but then there are few soils, even among those to which lime is added for the first time, in which some lime is not already present—and few, therefore, to which the whole of any of these quantities would require to be applied, in order to raise the quantity to three per cent.

It is an interesting fact in reference to the above quantities, that in Cumberland 12 tons, and in Annandale 8 or 9 tons, per imperial acre, are now not unfrequently applied to old grass land for the first time. On such land the whole lime may long linger in the upper three inches of soil.

But besides the depth of the soil, and the quantity of lime already present in it, there are many other circumstances which will modify the quantity of lime it will be proper to apply to the land. I shall consider these circumstances in the following section.

SECTION VI.—*Circumstances which Modify the Quantity of Lime that ought to be added to the Land.*

There are many circumstances, as I have said, which will modify the quantity of lime that may most profitably be added to the land. Thus—

* This table is calculated on the supposition that a cubic foot of soil has an average weight of eighty pounds.

† The bushel of lime varies in weight. If we take it at 75 lbs., there are 28 bushels in a ton, and the above weights are equal to 1300, 1000, 650, and 320 bushels respectively. In Dumfriesshire 27 bushels are considered to make a ton. But the bushel varies in weight in different parts of the island.

1°. *The nature of the soil* must be considered.

a. A light sandy soil must not be so heavily limed as a stiff clay. This is familiar to every farmer. Besides those purposes which the lime serves in the lighter soil, it is applied to stiff clays with the view of opening and rendering them more friable and mellow. This of course requires the presence of an additional quantity. In a clay soil also, the minute particles of lime are apt to become coated over with a thin layer of impervious clay, which prevents many of them for a long time from exerting their full effect in promoting the growth of plants. For this reason also a larger proportion is useful. Lastly, lime cannot be diffused through a clay soil so easily or so completely as through a light or sandy soil, and therefore it must be added in larger quantity in order that it may be made equally accessible to the roots of plants.

Hence in the same neighbourhood—as in parts of Renfrewshire, where 2 or 2½ tons are considered enough for the hill-side (sharp or gravelly) land, 6 to 8 tons are considered indispensable on the heavy land of the bottoms.

b. Such, again, as are poor in vegetable matter will bear less lime than such as are rich in decaying animals and plants. One of the uses of the lime is to combine with acid substances which are naturally produced during the decay of vegetable matter in the soil—the larger the quantity, therefore, of the dead roots and other parts of plants, the greater will be the demand for lime to perform this function. Besides, as dead plants afford the food on which new races of plants live, and as lime promotes the decay of the former and the preparation of the food they contain, it must be advantageous to the immediate fertility of the soil to add lime more abundantly when much vegetable or animal matter exists in the soil.

Still all soils, in which vegetable matter abounds, will not bear in an equal degree the application of large doses of lime. Our dry moorish heaths, covered with a black vegetable mould of a few inches thick, resting on a gravelly subsoil, often give excellent crops of oats, and even turnips and barley, when first broken up and limed, but afterwards become too light and open to grow oats and clover successfully. To such soils lime should not be added too lavishly; and means should be taken, by deep ploughing or otherwise, to mix up and solidify the surface soil, that it may contain on the whole a smaller per-centage of organic matter than the few inches at the top usually do in their natural state.

2°. *The state of the soil* is also of great consequence. If the land be wet and undrained, a larger dose of lime must be laid on. The moisture, like the coating of clay above referred to, shuts out the air, and prevents the lime from having its full effect. The coldness of such soils also checks the decomposing action of the lime upon the soil, and causes the production of a larger proportion

of acid matter—for both of which reasons more lime is required. Further, in wet land a portion of the lime not unfrequently forms insoluble compounds—mortars, silicates, &c.—which do not act in the usual way in benefitting the crops, and thus also larger applications are rendered necessary.

If the soil be a stiff clay as well as full of water, then larger doses still will be required; * and if it be also marshy, and therefore abound in vegetable matter, very large applications of lime must be laid on, in order to obtain the full benefits it is capable of producing.

3°. *The kind of cropping* is also of consequence. Green crops are benefitted by larger doses of lime than crops of corn. In reclaiming boggy land it has been observed, that while the addition of above a certain quantity of lime lessened the after-crop of oats, a turnip or potato crop, if taken first, was excellent in proportion to the quantity of lime applied. A similar remark applies to the ploughing up of lea. If corn is to be taken, the liming may be postponed, but, for a green crop, lime will generally be advantageous. By land which is lying in grass, less lime will usually be required in the same number of years, than by an equal extent in arable culture. Much, however, will depend upon the way in which the grass land is treated; and if it is cut for hay, more of course of every thing, and of lime among the rest, will be required than when it is kept in permanent pasture.

4°. *The kind of husbandry followed.*—An improving husbandry, for example, will call for larger applications of lime. If, as a means of improvement, the land be ploughed deeper, the lime will be diffused through a greater body of soil, and should therefore be present in greater quantity. Or if the land be drained and subsoil ploughed, with the view of removing noxious matters from the deeper soil, and of allowing the roots to descend, a more abundant liming may in the first instance be required—since it is desirable that some of it should find its way into the under soil, to aid in preparing it for the safe descent of the roots of the growing crops.

5°. *The form in which the lime, already present, exists in the soil* is also a matter of much importance. The soil may contain 6 or even 10 per cent of lime in the state of silicate, and yet pay for the addition of a considerable first dose of *quick*-lime, because this silicate must itself undergo decomposition, through the joint action of air and moisture, before it can produce the usual good effects which follow from the use of lime. A reasonable per-centage of gypsum may also be present, and yet the land may pay for liming;

* An instance is mentioned in the Nottingham report of 720 bushels an acre being laid on clay land without any benefit whatever.—*Brit. Husbandry*, i. p. 296. It is possible however that, being undrained, this land might already contain a sufficient *natural* supply of lime. Mr Stephens says, he has seen 510 bushels (nearly 20 tons) applied to wheat land with manifest advantage.—*Book of the Farm*, iii. p. 996.

because the gypsum is not fitted to perform *all* the functions of quicklime or of carbonate of lime in the soil. In this latter case, however, much will depend on the nature of the soil itself, on the kind of manure applied to it, and on the circumstances in which it is placed—points to which I may hereafter have an opportunity of adverting.

6°. *If the land has been previously limed*, a larger quantity is believed to be necessary to produce an equal *sensible* effect compared with that produced by the first addition. This may arise from several causes.

a. If the land be nearly destitute of lime when the first application is made, a very remarkable effect will necessarily be produced, since a certain proportion is necessary to the ordinary fertility of the land.

On a second or third application, the land already contains more lime than at first; and therefore a larger quantity must be added if it is to come in contact with as many particles of soil on which it can act, as the first lime readily reached.

b. For instance, the whole quantity of vegetable matter in the soil, or the quantity of that kind upon which it can readily act, may be less than it was on the first application; and hence the lime must be diffused through it in larger proportion, if it is to be brought in contact with as much of this vegetable matter, and produce as great a sensible effect as at first.*

c. But the good farmer will not often expect to see upon his old-cultivated land a sensible effect produced by lime equal to that which is seen when it is newly brought into arable cultivation;—the addition of lime from time to time, in good husbandry, being made rather to *keep up* the existing condition of a productive soil, than to add materially to its actual fertility. This point will be more fully discussed in a succeeding article.

7°. *The geological character and structure of a country* have also much influence upon the quantity of lime which its soils require; but this point is of so much interest and importance that it will be better to consider it in a separate section.

SECTION VII.—*General Influence of the Geological Structure of a Country on the Quantity of Lime which its Soils require.*

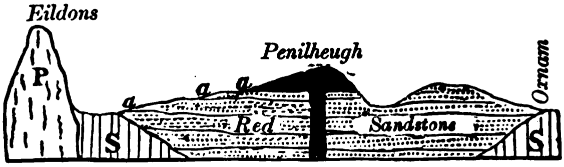
Of all the circumstances by which the application of lime is modified—the quantity to be added at once, and the frequency with which it should be repeated—there is none of so great and so general an importance, and at the same time so little understood by most practical men, as that of the geological structure of the district in which he lives.

* Another reason applicable to some soils is stated in Section VIII.

1°. Our soils are formed from the crumbled fragments either of the rocks on which they immediately lie, or of other rocks usually at no great distance. The soils, therefore, must consist very nearly of the same substances as the rocks themselves from which they have been formed. At all events, they cannot contain what is not present in the rocks, nor any thing, for the most part, in very large quantity, which is present in the rocks only in very small quantity.

2°. Now the rocks themselves differ very much from each other in different parts of the country. They differ especially in the quantity of lime they contain. Some consist almost entirely of lime—such are the chalk rocks, the cliffs of mountain limestone, and the beds of magnesian limestone. Others, like our sandstones and granites, contain comparatively little lime; while in our trap-rocks of various kinds a considerable proportion of lime is almost invariably present.

Hence, in a tract of country like that which is represented in the following figure—



where, in travelling from the Eildon Hills, which consist of a felspar porphyry, (P,) we pass over a slate country (S) to the red sandstone *a*, *a*, *a*, then over a considerable extent of trap, at the summit of Penilheugh, to the red sandstone, and finally to the slate country again about Oxnam,—in such a district as this, where we have four leading diversities of soil formed from as many different kinds of rock, in each of which the general proportion of lime is different from that contained in all the others, the importance and effects of lime, and the necessity for its application, must vary very much.

3°. There are three several ways in which the presence of lime in the original rock affects the quantity of lime contained in the soil which is formed from it, thus—

... which crumbles down and forms the soil, ... Thus the soil, when first formed ... same proportion of lime as the original ...

But ... is soluble in water under certain circumstances. Hence the waters that rise in springs, or ... flow from between the beds of rock—as at *a*, *a*, *a*, in the ... section—bring lime with them from the body of the rock ... and impart it to the soil through which the waters are diffused. ... this soil ... continues richer ... lime than it otherwise ...

The springs that gush out, often very copiously, from among the mountain limestone hills are generally charged with lime in a high degree. This is indicated by the luxuriant water-cress which lines the bottoms and sides of the streams; and I have often thought among the Yorkshire hills how valuable these streams might be made to the district, if they were employed in irrigating the pasture lands of the sloping valleys through which they flow.

c. A more general and permanent effect, however, is produced by the fragments of undecayed and decaying rocks which are mingled with the soil. These stones, upon land which is kept in arable culture, are often stirred up by the plough, and are thus exposed to the air and moisture. They undergo, therefore, a constant slow decomposition, and are continually yielding to the soil small portions of the different substances of which they consist. If they contain much lime, they yield a proportionably larger quantity of this substance to correct the acidity of the soil, and generally to aid the growth of plants. If they contain little, the artificial application of lime will be required more frequently, perhaps, and in larger quantity.

4°. *The granites and felspar porphyries* usually contain very little lime, and this is the case also with many of the sandstone rocks.

5°. *The mica slates* are also poor in lime. Some subordinate members of this series—the talc slates—are rich in magnesia.

6°. *The clay slates* appear to contain in general but little lime. In a variety from Wexford, analysed by Mr Antisell, six per cent of carbonate of lime was found. This is, I believe, an exception to the general rule.

7°. *The slate rocks of the Silurian system* vary much in composition—such as I have examined contain only about one per cent of lime. To soils formed from such rocks the addition of lime is indispensable, if they are to be brought into a state of profitable and permanent fertility.

8°. *The trap-rocks* usually contain much lime, and they are very abundant in Scotland. I shall further illustrate, therefore, the importance of a little geological knowledge to the practical agriculturist, by a special reference to the case of these rocks.

Section VIII.—*Special Influence of the Trap-Rocks upon the Quantity of Lime required by the Land.*

The trap-rocks do not cover a large portion of the surface of England—but they stretch in a broad but interrupted zone across the whole of the low country of Scotland, covering much of the several counties which lie between the Firths of Tay and Forth on the one hand, and the Firth of Clyde and the bay of Ayr on the other. They are spread also over a large surface in the north of

Ireland. The soils upon all this extensive space are formed more or less exclusively of the decayed fragments of these trap or whinstone rocks, and consequently either do now, for the most part, or have originally, contained a large per-centage of lime.

In order to ascertain correctly to what extent the opinion I had formerly expressed* in regard to the agricultural and economical importance of the lime contained in the trap-rocks was well founded, I collected a number of specimens from different localities, and caused them to be analysed in my laboratory. They were all found to contain lime in three different states:

a. In that of carbonate, either originally so existing in them, or formed by the decomposition of the silicate of lime through the action of the carbonic acid of the atmosphere.

b. In that of soluble silicates.—In this state it no doubt exists in the form of some of those numerous minerals usually called zeolitic by mineralogists, and which are for the most part soluble in muriatic acid.

c. In that of insoluble silicate.—This portion remains behind among the other insoluble matter, after the powdered trap has been digested in hot concentrated muriatic acid.

The following table shows the proportions of lime in each of these states contained in the different specimens of trap which were examined, and also the whole per-centage of lime, and its equivalent in the state of carbonate:—

QUANTITY OF LIME CONTAINED IN ONE HUNDRED POUNDS OF DIFFERENT VARIETIES OF TRAP.

Locality.	Lime in state of carbonate.	Lime in state of silicate.		Total lime in the trap, calculated as	
		soluble.	insoluble.	caustic.	carbonate.
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*
Balcarres Hill, Fife (recent)	0·8	4·26	5·75	10·81	19·21
Pentland Hill, near Swanston (decaying) . . .	8·2	0·12	2·78	11·10	19·75
Salisbury Crags (recent) .	3·02	2·18	2·48	7·68	13·64
Ditto (decomposed) . .	0·72	0·71	0·91	2·34	4·16
Rothsay (decayed) . .	0·68	0·51	6·85	8·04	14·22
Langton, Berwickshire (amygdaloidal)	4·26	0·08	...	2·48	4·40
Colquhalzie, Perthshire (micaceous) . . .	5·49	...	1·05	6·54	11·61

Several facts are strikingly presented in this table:—

1°. That some of the traps contain as much lime as is equivalent to one-fifth of their own weight of carbonate. Such, among those in the table, are those of Balcarres and the Pentlands—of which every 500 lbs. contain as much lime as is present in 100 lbs. of pure limestone.

* In the first edition of my Lectures on Agricultural Chemistry and Geology, p. 385. See also second edition, p. 40[illegible]

2°. That in others the proportion of lime does not exceed two-thirds of this quantity; while in others, again, the whole lime present scarcely exceeds two per cent. These differences will, of course, materially affect their agricultural value, and the necessity for the application of lime to the soils formed from them.

3°. That the quantity contained in such as have been partially decomposed is usually less than in the same variety when in a recent state. This is what we should expect from the known action of the rains and other causes, in washing lime from rocks and soils.

4°. That in some, as in those of the Pentland Hills and of the Salisbury Crags, the proportion of lime in the state of carbonate is very much greater than in others. This arises in part from their originally containing more in this state, since most of the whinstones effervesce with acids when quite fresh and newly broken from the parent rock. Still, in such as have been long exposed to the air, and have begun to crumble, a portion of the carbonate may be derived from decomposed silicate.

It is obvious, therefore, that the original presence of so much lime in our trap-rock soils must materially modify both the quantity which will require to be added to them, and the frequency with which it must be repeated.

There are four important practical points which, among others, are explained by a knowledge of the presence of this lime:—

1°. We have already seen that decayed trap contains less lime than such as is recent or undecayed. The same is the case with the surface of a trap-soil. We shall by-and-by see, indeed, that the upper portion of nearly all soils is gradually deprived of lime by the agency of natural causes.

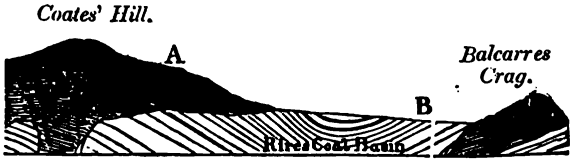
If, therefore, a trap-soil remains long in an unimproved state, or even very long in pasture, it will, when broken up, and even when still left in grass, exhibit as great an improvement from the addition of lime as almost any other land in similar circumstances. But when the ordinary period arrives at which it is usual to renew the application of lime to other kinds of arable land, it will often be found that the second dose of lime has little apparent effect on the productiveness of these trap-soils. This effect arises from the circumstances:—

a. That when first broken up, most of the lime which existed near the surface in the state of carbonate had been washed out; and though there might exist many fragments of undecayed trap in the soil, yet they were not exposed to the air in such a way as to admit of their being rapidly decomposed. When broken up, therefore, an artificial application of lime was required to produce those immediate effects which, in reclaiming land, this substance is fitted to produce. But,

b. After it was brought into arable culture, the turning up of the soil exposed those fragments of rock to the air, and thus caused them to decompose, and, year by year, to yield a portion of carbon-

ate of lime to the land. The effect of this must obviously be retard the natural exhaustion of the lime, and to put off the pe when a new dose of lime may be profitably given.

The counties of Renfrew, Fife, and Ayr present many illus tions of this fact. The following figure represents a portio the south-eastern portion of Fife, in which T T are two of the l masses of trap which form so much of the surface of that cou The soils which cover the long slopes on either side of Co Hill are in the condition of much of the land in the cou



above-named: if once well limed, it is long in requiring a rene So much is this the case, that in many parts of Fife liming almost fallen into disuse—from the persuasion, on the part of farmers, that, though it did much good to the land in their fath time, it now does no benefit to them. The time is coming ro again, however, when most of them will return to the prac of liming as a profitable mode of improvement.

2°. Apparent contradictions in practical experience are rec ciled by it. I some time ago attended a meeting of the St Qui Farmers' Club, held at Ayr, at which the subject of conversat was the use of lime. Among the fifty intelligent men who w then present, a considerable number declared, from their own ex rience, that lime was of no use to the land whatever; while as ma others pronounced it to be a most useful and profitable applicat —and one large farmer stated that he had been laying it on his la at an expense of several hundred pounds a-year, and was so w satisfied with his returns that he meant to continue the practice.

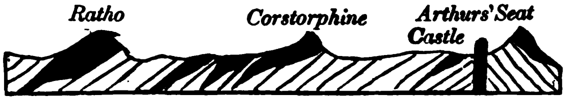
In the patches of trap scattered over its surface, the county of A resembles the county of Fife. Suppose two farmers, situat respectively at A and B on the preceding figure—one on a tr soil, and the other on the stiff and cold clays of the coal-measures and suppose an equal time to have elapsed since lime was laid up the two farms. The tenant at A applies lime to his arable lan and he finds his money apparently thrown away. The tenant B lays it on at the same time, and his crops are greatly improve If these men meet in a club, they will each give correct opinio as far as their experience goes, and yet the experience of t one will contradict that of the other. But, the natural differenc in the origin and nature of the soils being understood, t cause of the seeming contradiction, and of the unlike resul obtained by different persons, becomes apparent. It is clear als that though a trap-soil requires less lime in a given number years, and is therefore less costly to work on the whole, yet th

the greater number of such soils will require occasional liming, especially if laid down to grass; so that even upon them a time will always arrive when it will not appear to be thrown away. A little more of this kind of knowledge would not only render our practical men less broad in their statements and confident in their opinions, but would also help them materially in the economy of their rural operations.

3°. An important agricultural fact in connexion with these trap-rocks is, that they are the means of giving lime to the soils which lie beyond their own limits. This I have, in some measure, illustrated in a previous article, when speaking of the origin of marl beds. The rains and springs bring down lime from the trap-soils to those which adjoin them, and which, as in the part of Fife to which I have already alluded, may be naturally of a very different character. The heavy rains wash even the finer parts of the soil itself down the slopes of the trap-hills, and thus fertilise the valleys or flats below. Hence, in a district such as in the neighbourhood of Edinburgh, over which, though not entirely covering it, the outbursts of trap are very frequent, the advantage of liming, so long as they are kept in arable culture, may be only at rare intervals experienced upon many of its farms. The trap-soils themselves derive lime from the decaying fragments of rock which are mixed with them, while the adjoining soils are enriched with lime from the washings of the trap-soils around them.

The general experience, I believe, of practical men in the neighbourhood of Edinburgh is expressed in a remark once made to me by the late Mr Oliver of Lochend, "that he had never known an instance in which the application of lime had done any good within five miles of Edinburgh." I have no doubt that Mr Oliver's remark was substantially correct; and one main cause of the result he referred to is distinctly seen in the geological structure of the country. Another influential cause is probably the extensive use of the town or police dung, in which coal ashes, much lime refuse, and sea-shells are contained.

I have already given in a previous article a figure of a portion of the immediate vicinity of Edinburgh, showing the relative positions of some of the most remarkable of the trap-rocks near that city; but the prevalence of these rocks over the whole of this part of the Lothians is so strikingly shown in a figure given by Mr Maclaren, in his Geology of the Lothians, that I am certain I shall gratify my readers by inserting a part of it here.



The shaded spots in this figure are all trap-rocks, and they cover a considerable proportion of the entire surface of the country. But the hollows between the shaded portions will be benefited by

the washings from the trap above; and where the space uncovered by the trap is comparatively narrow, as between Corstorphine and Ratho, the necessity for lime may be less urgent than where the distance from hill to hill is greater—as between the Castle rock and the Corstorphine hills.

4°. This figure illustrates also a fact which has frequently puzzled practical men, that lime is sometimes more required, and produces a greater effect, on one side of a hill than on another. The slopes of the Corstorphine hills towards Ratho will obviously derive more benefit from the constituents of the adjacent trap-rocks than the plains that lie towards Edinburgh; and the same remark applies to many other localities of a similar kind, and even to hills which, like those of the mountain limestone, belong to a different geological formation.

I have recently been amused by a discussion upon this subject which has taken place at the Newcastle Farmers' Club,—in the course of which, it was stated to be my opinion that *lime would do no good on the slopes of the Cheviot hills*,—and that, as it was really found to do so, *lime must have some especial action on soils of volcanic origin.* The reader of the present article will judge what degree of faith is to be placed in either of these statements.

SECTION IX.—*Of the Quantity of Lime usually added to Arable Land in different districts.*

Many circumstances, as above shown, must modify the quantity of lime it will be most profitable to add to the land. It is of importance to the practical man to know, however, what are the quantities of quick-lime actually applied to land kept in arable culture—where the benefit of adding lime has been proved by experience. The following table exhibits the proportions usually added in some of the best cultivated districts in the island, compared with the custom in Flanders:—

QUANTITY OF QUICK-LIME APPLIED PER IMPERIAL ACRE IN DIFFERENT DISTRICTS.

	Bush.		Years.	Bushels a-year.	When applied.
Roxburgh,	200	every	19	or 10½	to the fallow.
Ayr (Kyle),	40	...	5	or 8	do., or lea.
Carse of Stirling,	54	...	6	or 9	do.
South Durham,	90	...	12	or 8½	do.
Worcester,	70	...	6 or 8	or 10	before grasses & tares.*
Flanders,	50 / 12	...	12 / 3	or 4	

*This is the practice on the stiff clays near the Malvern Hills. The rotation [illegible] followed is—1°. Naked fallow; 2°. Barley (formerly wheat) and a few turnips; 3°. Clover or seeds; 4°. Wheat; 5°. Beans, peas, or oats; 6. Vetches (soiled) with manure, followed by naked fallow. This rotation is certainly not the best, though it may be an improvement on the old four-course of wheat, beans, wheat, and fallow. The quantity of lime applied is stated to me by a correspondent to be from 90 to 100 bushels in eight years; but as the bushel weighs only 45 lbs., I have [illegible] this quantity in the table given in the text.

The quantity applied in this country appears, from the above table, to be pretty uniformly at the rate of from 8 to 10 bushels a year, except on stiff and imperfectly drained clays, like those of the vale of Gloucester. Some apply it in larger doses and at longer intervals than others; but the average quantity added to dry land of medium quality, is, on the whole, nearly the same. Of course, in too many cases, the expense of the application prevents the tenant-farmer from laying on a sufficient supply.*

In Flanders, again, and in parts of France, the proportion added is less—being on an average not more than half the quantity laid on in this country. The lightness of the soils in Flanders, and perhaps also the climate and the care with which all other kinds of manure are collected and preserved, may in some measure account for this diversity.

The above mode of reckoning by bushels, however, is very uncertain, because of the unlike weight per bushel of different varieties of lime as it comes from the kiln. In the neighbourhood of Alnwick, the bushel weighs from 75 to 80 lbs., and in Cumberland and Dumfries is taken to be 81½ lbs., or 27 bushels to the ton; while the bushel of Malvern lime is reckoned at 45 lbs., little more than one half as much. The application of an equal number of *bushels* in these two districts, lays very unlike weights of lime upon the land. Such application should always be made by weight, and the weight should be taken as the lime is drawn from the kiln.

The reader will bear in mind that in this section I have spoken only of the liming of arable land. The practice in regard to pasture and meadow land is very different. Hill pasture is sometimes tripled in value by a single liming. When limed for the first time, 8 and 12 tons are often laid upon an imperial acre, and the effect remains visible for 50 years. The northern slopes of Moray exhibit this effect; and those of Annandale are now obtaining the means of similar improvement by the opening of the Caledonian Railway.

SECTION X.—*Influence of the Geological Structure of the country on the kind of lime which ought to be added to the land.*

The *quality* of the lime he applies is of little less moment to

* The converse also is often the case where lime is cheap. Thus in the poor, cold undrained land immediately south of Durham,—where the rotation is fallow, wheat, oats or fallow, wheat, oats, hay—it is customary either to lime or manure every fallow—usually to lime once in six years. The quantity applied is about four double loads—between four and five tons—to the imperial acre; or 20 to 25 bushels of 80 lbs. each year. The tenant is not to blame for this profuse liming. The landlord, who refuses to let his farms for a longer term than six years, is punished by the more speedy exhaustion of his land. These poor lands would become rich under a longer tenure and a more liberal management.

the practical man than its quantity. In most districts in which different qualities of lime are to be procured, with nearly equal ease, the farmer selects that which he has found—or which he believes to be—the best adapted for his particular soil.

1°. Thus, of the Irish limes brought by sea and used in Ayrshire, the Drogheda—a blue lime, which burns to a light gray or ash-colour—is considered best for general purposes, but particularly for heavy soils. The Cork and Dublin limes, which are darker in colour, are also good for stiff land, but are considered inferior to the Drogheda; while the white lime (chalk) from the county Antrim, is superior to either for lighter soils. These different qualities arise probably from the different proportions of earthy matter which the limes contain, and the different degrees of fineness to which they fall when burned and slaked. The Antrim lime falls to an exceedingly fine powder, and is thus better adapted to the more open and loamy soils.

2°. But the most important difference which exists among those varieties of lime that are usually applied to the land, is in the proportion of the magnesia they contain. This difference, as I have already shown, is often very great.

But in addition to what was formerly stated in regard to the absolute quantity of magnesia contained in certain limestones, it is of importance to the practical man to know that limestones from the same locality often vary much in this respect.

Thus in the same quarry, on the farm of South Whinny Hall, near Burntisland, in Fifeshire, three different beds are worked, which, according to analyses made in my laboratory, consist respectively of

	Upper Bed.	Middle Bed.	Lower Bed.
Carbonate of lime	86·07	57·18	89·84
Carbonate of magnesia	9·53	32·90	3·02
Alumina and oxides of iron	3·11	8·62	1·42
Siliceous matter and clay	1·25	1·18	5·69
	99·96	99·88	99·97

The difference in chemical composition of these three varieties is such as materially to alter the quality and value of the addition made to the soil, according as the one or the other variety is used.

a. Now, among the rocks from which soils are formed, there are some which abound in magnesia, and others in which this substance is found in comparatively small proportions. Thus, the magnesian limestone rocks usually contain much magnesia, as their name implies. To soils formed from this rock, when lime becomes necessary, it should be safer, according to theory, to add a lime in which magnesia is less abundant; and experience proves this to be really the case.

b. So, among the beds of the mica slate series, those to which the name of talc slates is given contain much magnesia. A frag-

ment of such slate from Banffshire, lately analysed in my laboratory, was found to consist of—

Oxides of iron and alumina soluble in acid	13·83
Alumina, with a little oxide of iron, insoluble in acid	20·21
Lime	1·44
Magnesia	4·08
Potash and soda	7·28
Silica	52·65
	99·49

Such slates as this will form stiff retentive soils in which lime will be deficient, while magnesia will be present in comparative abundance. In liming this land, therefore, regard should be had to the composition of the lime; and a variety should be selected in which the quantity of magnesia present is comparatively small.

c. Other soils again occur—such as those which are formed by the decay of the felspar rocks—in which magnesia is deficient, and to which, therefore, experience may have shown that it is more profitable to apply a kind of lime in which magnesia exists in larger proportion.

d. Even alluvial soils formed from the mud of rivers,—which is seldom derived from the decaying fragments of one rock only, or even of one geological formation,—are not unfrequently so much richer in magnesia than in lime, as to make it by no means a matter of indifference what kind of lime is added to them by the practical man.

Thus, a soil from Blackhall, which has lately been reclaimed from the Forth, was found by one of my assistants to consist of—

Organic matter	6·29
Alkaline salts	0·77
Sulphate of lime (gypsum)	0·43
Chlorine	0·08
Carbonate of lime	0·84
Carbonate of magnesia	2·06
Alumina	6·59
Oxide of iron	6·37
Insoluble siliceous matter	77·05
	100·48

in which the proportion of magnesia was more than twice as great as that of lime. So much greater, indeed, is it, that while an acre of the land, supposing it 12 inches deep, contains less than 14 tons of carbonate of lime, there are present in it no less than 33 tons of carbonate of magnesia. In adding lime, therefore, which this soil requires, it cannot be a matter of indifference whether the variety added abounds in magnesia, or is almost entirely composed of pure lime.

Numerous other soils have been submitted to analysis in laboratory, in which magnesia has been found in sufficient ab dance, while lime was greatly deficient; and in regard to treatment of which, I have had occasion to recommend the plication of heavy doses of lime, with this caution, that th varieties should be selected in which little magnesia was c tained.

The consideration of all these facts shows how important, reference even to practical purposes, a knowledge of the geolog structure of a country is,—how necessary that the general ori and composition of the soil should be ascertained,—*and that neit lime nor any other substance should be applied to it of which chemical composition is not exactly known.*

FRENCH AGRICULTURAL STATISTICS.*

THIS valuable and highly interesting work is the joint product of two very clever men—one of whom has ably arranged a v amount of statistic information, derived from a large mass of offi reports presented to the late King of the French: the other, hav skimmed the cream of the matter collected by his fellow labou has reasoned upon the elements of which that matter is compos and deduced conclusions with good taste and discriminati And there is no reason to question the correctness of the offi returns which constitute the groundwork of the publication bef us: the manner in which those returnshave been collected, scrutinis and revised, warrants their accuracy.

In our domestic empire, where the principle of centralisat does not prevail, such reports could not be obtained without intervention and specific employment of an immense staff of offici at a vast expense, nor could the returns be depended upon strictly accurate, from the conflicting evidences they would nec sarily comprehend, arising from the various objects, prejudices, interests involved in them: but in France, the administrative s tem by which statistic information can be readily obtained by Government, through the *prefets* and all their subordinate offic presents in that kingdom a facility of acquiring such informat which we do not possess, from the want of salaried and discipli *employés*, maintained so numerously in France, (on very inexp sive terms too,) and willing to discharge any extra-routine labc in the expectation of gaining a step on their professional ladder, the exercise of zeal and intelligence. Though a great numbe

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* *De l'Agriculture en France, d'après les Documents Officiels.* Par M. L. Moun *Avec des Remarques* par M. RUBICHON. Paris, 1846.

persons was employed in preparing some of the Reports to which we shall soon more particularly advert, the expense has been comparatively inconsiderable; the means taken for checking one return by another, or one item of a return by corresponding items in others, is deserving of unqualified approbation.

In their preface, the authors have alluded to the distinctions between English and French statistic reports. Respecting the former they observe:—

They fill more than 200 thick folio volumes of small type, composed of questions and answers, without plan or method; but it is a body of information unreservedly laid before the public. The facts, their causes and consequences, have been sifted and compared, and every individual has had the privilege of informing himself on whatever belonged to his own occupation. . . . . . . The French inquiries are not conducted on the same plan as in England: there, the persons interested have made out their own statements, whereas, in France, these have been made by the state authorities. In each case, however, intelligence and honesty of purpose have been displayed. The French returns are arranged methodically, and they are therefore much less voluminous than those of England: every man may find leisure to examine the tables presented by the Government, on the agriculture of our different provinces. The same approbation, however, cannot be given to the several reports of the Minister, because he is tinctured with the principles of the revolutionary school, and frequently adduces as a proof of prosperity, that which is an evidence to the contrary.

Our parliamentary reports are in part obtained through corn-dealers, and are by no means to be considered accurate; yet great faith may be reposed in them. Many of our legislative committees have taken the utmost pains to investigate every thing connected with agriculture; and though some of our reports—British and Irish—are too voluminous, they are capable of being at any time so classed and analysed, as to afford information that may be implicitly relied upon.

The two writers, whose labours embrace too large a field for a regular analysis on our part, thus disclose their motive for publishing. Having assumed as an axiom that the science of agriculture is less understood in France than in the rest of Europe, though three-fourths of her population are devoted to agriculture, and believing that England is right, they have been anxious to render the English system known, and to compare it with the French: besides, the magnificent exertions which the English and French Governments have made, within the last ten years, to extend their inquiries respecting agriculture and so many branches of human science, deserve to be known.

The principal portion of the first volume relates to territorial property, the remainder to agricultural produce. The great body of the matter being selections from official reports presented to the King of the French, in 1840, by M. Gonin, Minister of Agricultural Commerce. That statesman, after giving an historical sketch of the difficulties which former ministers experienced from the time of Louis XIV., arising from the inaccuracies of maps, and their extraordinary disagreement; the want of registrations respecting the divisions; the irregularity of assessments, which differed thoughout the provinces in form and amount; the defectiveness of population returns, without an exact knowledge of which no true estimate could be made of the amount of agricultural produce consumed; the fruitless efforts made by Louis XIV. to ascertain the extent of cultivation and production; and the subse-

quent lapse of an entire century without any progress,—mentions, in proof of ignorance and difficulties which prevailed, this curious fact :—The scientific a culturist, Arthur Young, in 1788 was led, in order to obtain statistic data v respect to the extent and physical condition of the different parts of France, to sect a general map into the parts he wished to compare with each other, and weigh the sections against each other ; by this means he was able to compare superficial extent of any given part as it was indicated on the map, with any ot given part, and to judge also of the amount of aggregate surface.

Accordingly, Mr Young himself tells us, that Paucton found the kingdom contain more than eighty-two and a half millions of English acres.*

Lavoisier, who had been one of the great superintendants of the land taxes, no better means to propose to the National Assembly, 1790, for obtaining stati information respecting agriculture, than that of taking the number of ploughs the basis of all the computations. He assumed that there were in France

320,000	ploughs drawn by	horses
630,000	"	oxen
940,000		

	Arpents.		Hectares.
That each plough drawn by horses, worked in autumn,	30	or	15·32
" oxen, "	15	or	7·66
" horses, in spring,	30	or	15·32

And he inferred that there were annually

Arpents.		Hectares.	
9,600,000	or	4,902,910	cultivated by horse labour in autumn
9,000,000	or	4,596,480	" oxen "
9,600,000	or	4,902,940	" horse in spring
Total, 28,200,000	or	14,402,300	under corn.

It was taken for granted that the fallows were of the same extent with that of land in autumn ; and that consequently there were

Arpents.		Hectares.	
9,600,000	or	4,902,910	in the districts cultivated by horses
9,000,000	or	4,596,480	" oxen
Total, 18,600,000	or	9,499,390	in fallow.

They assumed further, that there was an extent of grass land in the districts ci vated by oxen double the quantity in fallows, viz. :—

18,000,000 arpents, or 9,193,000 hectares, in common pasturage.

These combined numbers led to the belief that there were altogether :

	Arpents.		Hectares.
Under grain crops, ...	28,200,000	or	14,402,300
In fallow, ...	18,600,000	or	9,599,390
In grazing land, ...	18,000,000	or	9,193,000
Total culturable land, ...	64,800,000	or	33,194,690
Meadows, woods, &c., ...	40,200,000	or	20,530,910
Total surface, ...	105,000,000	or	53,725,600

* M. Necker computed the extent to be nearly 132 millions of acres—a calcula which Young believed to be correct, and which has been pretty fairly proved to l been so.

Such was the guess-work system by which the extent of surface was measured; until Napoleon, aware of the importance of having general statistic information, had France divided, in 1810, into departments; regulated the *cadastre*, or land valuation law, under which the land tax is registered; and endeavoured to establish uniformity and exactitude of system not previously operating, which tended greatly to develop the agricultural statistics of the kingdom.

But he went to work so fast that accuracy was out of the question. He expected that all the civil authorities, from the prefets downwards, would act with the promptitude and despatch of military men in a campaign: 334 questions were addressed in a circular to each prefet, and to each of these he was required to furnish exact replies, under pain of dismissal, within two months. The returns were therefore exceedingly defective, so much so that the new government, in 1814, was obliged to adopt another course for obtaining information on the state of agriculture. The statistics were so incomplete that there was no possibility of obtaining from the official documents the relation between food and population, nor on other points on which the legislature required information. Though in some things the aggregate inductions respecting a large extent of surface might have been tolerably correct, the partial matters, in detail, from which those inductions were formed, were often arbitrarily assumed and erroneously estimated. In 1836 the plan of a general statistic view of France was drawn out; and the prefets were ordered to prepare its materials by a prescribed formulary, the leading rules of which were, that the 37,300 communes should supply the elementary statistics—such as superficial extent, amount of productions, of live stock, and a table of the produce consumed; that such details should be collected and arranged for the cantons of which the communes were the subdivisions; that the data thus furnished should be collected into reports for the arrondissements, and these again condensed into departmental returns, and from these other summaries were again made for four great districts.

To attain the object, instructions were addressed to the prefets and mayors, with such modifications and changes as the local circumstances required, accompanied with a tabular form containing instructions for filling the columns with cyphers expressing in measurement or decimal coin the extent of each kind of culture, pasturage and woods, the quantity and value of their annual produce, and the quantity of each kind consumed. The reverse of that table showed the number of the different kinds of domestic animals, the value of each, and their average and total yearly value. These data were completed by returns of the number of animals slaughtered, and every thing bearing on the subject of food, in its quantity and quality, whether in the aggregate of parochial consumption or by each family.

As the mayors of communes are frequently very clownish and ignorant, the prefets were empowered to engage competent persons to assist them in their work. Some impediments were thrown in

their way, however. As the peasantry of Ireland, in some localities, viewed the preliminary operations of the ordnance survey with suspicion as a preparation for taxing, so did the French peasantry in some instances either bid open defiance to the government *employés*, or evaded giving the required information. Their varying and confused notions of measurement, too, and their illegible style of writing and cyphering, the then incompleteness of the valuation books and registries, the novelty of the work itself, and their jealousy of salaried agents, tended to impede the undertaking.

To meet the difficulties which arose from the omission of figures, or numerical errors, the prefets submitted the communal (parochial) tables to revising commissioners for cantons and arrondissements, and afterwards to a central departmental commission. Great amendments were introduced by the scrutiny of talented and practical men, acquainted with agriculture, and possessed of local knowledge. To obtain throughout France, without a single exception, the 37,300 tables of agricultural statistics, was the most difficult part of this vast undertaking; but another labour, almost as tedious and arduous, was necessary to turn the materials to account, viz.—the sifting and rearranging of them. To think of publishing a statistic work by communes was out of the question, for this would have formed a library of 250 quarto volumes, of 300 pages; and the matter of them, however important, would have been buried under an enormous mass of details. It was therefore necessary, in order to compress the work within convenient limits, to separate, cypher by cypher, the communal tables, and from them to construct arrondissement tables, divided by the sort of produce. Thus the numerical terms of 19,000 communes of eastern France were so reduced as to be represented by those of 177 arrondissements, and 830,000 numerical terms were comprised into 8000 or 9000, by adding their constituent parts in some instances; for example, 289 lines relating to wheat alone, furnished by the arrondissement of Laon, have been comprised in one line; and all cyphers giving the details of wheat in the 839 communes of the department of Aisne, have been analysed in six lines, in a table which clearly and faithfully shows the general results in that department.

The report goes on to suggest, for the classification of the departments in districts, with reference to climate and soil, geographical position, and other analogies, that the kingdom should be divided into four zones or regions, which the official statistics actually do,—and a table is presented, which is acknowledged to have been after the design of Arthur Young, who made a similar division of the kingdom for his own statistic purposes. The tabular division of France, in the work before us, has been constructed accordingly.

On looking into the contents of this table, there seems to be no good reason why the numbers in the 1st and 3d columns have not been united. The next table presented on the same plan will no doubt be more completely arranged, and the cyphers in the columns of unclassed soils [illegible] placed under some definite classes of soil. The table is in fa[illegible] [illegible]e are told, a digest of the official statistics col-[illegible]ected on Arth[illegible] [illegible]oung's plan

TABLE OF THE QUALITY AND EXTENT OF EACH SORT OF SOIL IN FRANCE.

	Extent in Hectares.												
	Mountain.	Undulating and flat.	Mountain.	Heath and Wastes.	Rich Loam.	Calcareous	Gravel.	Slate.	Sand.	Clay.	Marsh.	Undefined.	Total Extent.
North West,.........	336,384	12,114,933	336,384	1,330,609	2,156,065	1,846,366	560,484	1,547,600	1,190,388	816,939	83,800	2,582,682	12,451,377
North East, ...	2,461,725	10,381,611	768,655	454,796	2,489,990	3,185,581	1,185,335	1,616,719	769,506	509,424	126,130	1,737,200	12,843,336
South West,.........	1,262,796	12,048,952	961,896	2,124,032	1,470,636	2,422,958	678,954	1,606,966	2,224,706	556,322	...	1,271,278	13,311,748
South East, ...	2,312,442	6,975,021	2,201,815	1,416,651	1,084,677	2,299,792	993,120	1,661,063	1,736,777	356,200	74,524	1,462,844	13,287,463
North, ...	2,798,109	22,496,544	1,105,039	1,785,405	4,646,055	5,031,947	1,745,819	3,164,319	1,959,894	1,326,363	209,930	4,319,882	25,294,653
South, ...	7,515,238	19,023,973	3,163,711	3,540,683	2,555,313	4,722,750	1,672,074	3,268,029	3,961,483	906,522	74,524	2,734,122	26,599,211
Continental France,	10,373,347	41,520,517	4,268,750	5,326,088	7,201,368	9,754,697	3,417,893	6,432,348	5,921,377	2,232,885	284,454	7,054,004	51,893,864
Corsica,...............	825,000	49,746	...	350,000	75,000	33,500	...	180,000	...	...	...	236,246	874,746
France, ...	11,198,347	41,570,263	4,268,750	5,676,088	7,276,368	9,788,197	3,417,893	6,612,348	5,921,377	2,232,885	284,454	7,290,250	52,768,610

M. Rubichon, after some very interesting remarks on the feudal and Roman laws, and their influences on the tenure of land, observes with respect to the foregoing table, and some others relating to the elevation of mountains and the population estimated by square leagues, that—

> These tables give rise to disheartening reflexions for a Frenchman. We see that on 100 hectares of surface, there are but 14 of rich soil ; the rest is composed of marsh, gravel, argil, chalk, or stones. The soil of England is pretty nearly analogous ; but what have the proprietors effected there within fifty years ? Their scientific men have analysed the constituent parts of the best soil. Gravelly soil requires an admixture of argillaceous and calcareous substances, therefore the proprietors made two canals, one of which conducts to the argillaceous, the other to the calcareous soil. They have in a similar manner brought together the marshy and sandy soils. Thus the surface of the country has in fifty years undergone a change, and in consequence of this new direction of agricultural labours, there is a continually decreasing necessity for plough or manual labour upon the soil, and its produce is daily increasing. It has been seen from the evidence of Scotch farmers, that they were formerly obliged to apply an enormous quantity of calcareous manures to sustain the fertility of their land under the 56° of latitude. One of them says that he lays upon his land continually increasing proportions of lime ; and that, on a given breadth of land, he now puts 15 cubic yards where he formerly put but 6.*

And no doubt the English canals, running through the great towns and limestone districts, have greatly facilitated the transit of fertilising substances ; but the annotator seems to be labouring under some strange misapprehensions of the ingenuity and industry of English farmers, who, in his opinion, by the Bridgewater canals alone, are enabled to make a sort of plum-pudding soil of the little island, by shifting the original soils north, east, south, and west, intermixing them according to one of Mrs Meg Dodd's receipts. He has either drawn very wide deductions from some very narrow premises, or has been deceived by some agricultural wag. This reminds us of a story recorded (we believe by the late Mr Inglis) of a Frenchman travelling in Ireland, who, on expressing his surprise at the number of cur dogs in every town and village, was told by a humourist, (and believed and published the information as a fact,) that numerous dogs were kept in Ireland to bark after the post-horses from stage to stage, in order to keep them going.

In another part of the work, in which he truly enough attributes the superiority of British horses to the national love of the chase, succeeding to that of war and tournaments in bygone days, he says,—

> There are at this day great lords in North Britain,—among others, the Duke of Hamilton,—who have kept up the primitive races of bulls, in order to afford themselves the pleasure of fighting against these untamable animals, who fight to the [illegible] their blood. It is necessary to oppose to them bold and intrepid horses ;

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* Th[illegible] passage [illegible] explanation. The annotator probably means that a Re[illegible] from Berw[illegible]kshire shows that our farmers now use more calcareous manure [illegible] formerly, finding the grain of their corn thereby greatly improved, and the [illegible] proportioned to the expenditure of such manure.

and *it is for this reason* that the nobility of England have been so much devoted to the breeding and improvement of horses, long before this had been thought of in France, though her nobles only fought on horseback. But being always absent from their estates, to defend their country or its allies, they could not bestow on their horses the care which the English aristocracy have given.

Omitting particular allusions to the history of land property in France, and the past and present laws affecting it, we proceed to notice the statistics which immediately relate to the subdivision of land—a fruitful source of calamity to agriculture, and to which, among other causes, the deteriorated value of land in France is chiefly attributable.

M. Rubichon says that—

Germany, within fifty years, has, like France since the reign of Louis XIV., felt the fatal effects of too small a partition of land, by which the amount of production increases less rapidly than that of the population. The war of extermination which France pursued from 1795 to 1815 arrested the subdivision of land, by destroying so many co-heirs, thinning the population, and raising wages. War and pillage occupied all the turbulent spirits; but since the peace of 1815, and the conversion of swords into ploughshares, the partition of land by inheritance received a new impulse, which, instead of being restrained by the legislature, was, if not more accelerated, certainly left by the ministry of the country at least as forcible as it had been.

The Minister of Agriculture, &c. published a return in 1837, which shows that the entire area of France, excepting less than three million hectares for state forests and domains, roads, streets, rivers, and lakes, is liable to a tax; and that the average of such tax, imposed by cadastral valuation on the forty-two northern departments, is a fraction less than three francs per hectare, (one shilling per English acre,) and for the forty-three southern departments two francs per hectare, and that the average on the entire kingdom is a fraction under two and a half francs per hectare.

The number of proprietary families in France exceeds five millions and a half, and these have among them more than one hundred and twenty-three millions of allotments; consequently many different allotments of land—so inconvenient for agricultural purposes—are held by the same proprietor. The separation of holdings by sales or the divisions consequent on inheritance, instead of having some close reference to the number of proprietor or agricultural families, seems to have no limit whatever; and with each generation of men the property of a family, whether one hundred hectares or but one, subdivides,—the extent of farms continually diminishes as the number of individuals in each family increases. The effects of this subdivision, which is perpetually advancing, especially on the best soils, in preventing the practical improvements in husbandry, which a large scale of farming tends to advance, are thus pointed out. Above all, this system (referring to the patches of unenclosed land held by many proprietors in the same field,) renders it impracticable for any occupier to till his land according to his wishes, to establish a fixed course of cropping best suited to the character of the soil, to plant hedges and trees, to grow artificial grasses, to enclose for pasturage, and to abandon the old and wasteful practice of fallowing, because an intelligent man, with the will and the means for cultivating the entire of a farm regularly, according to the laws of vegetation and local facilities, could not do so when his land is in distinct and scattered lots—dove-tailed into those of his neighbours, who are either fallowing or grazing them. Any individual who would pursue his distinct system would soon see his crops exposed to the continual trespassing of the village cattle; and if he should go to the expense of raising fences to protect them, he would assuredly see them every day injured by the other occupiers of the unenclosed lots. Besides, even if his enclosures were not trespassed, we can understand that they would occasion much cost, and a loss of land, by taking up so much of it for walls, hedges, and ditches—too great an extent of surface in proportion to the size of the numerous enclosures.

This is excellent matter, and strengthened by a remark of M. Thaër, (rather an extreme one, however,) who says that, in the

judgment of every enlightened agriculturist, small dispersed holdings are of less value, by one-half, than if they were united, and could be tilled without any restrictions or impediments.

The total changes of property in France by inheritance, sales, or bequests, from 1836 to 1846, have been the enormous number of 23,348,286,541 !

In the N.W. the number of proprietors whose rentals amount to 17,000 francs is 6,831; in the N.E. 3,248; but in the S. districts there is not more than half of the latter number of such large proprietors.

There are 2,500,000 families whose average freehold property does not reach 30 francs; and this number of unfortunate beings, bound to the soil, is continually augmenting in an increasing progression. Of the three-fourths of the 7,000,000 families in France, 5,200,000 live by agriculture, out of which number four millions at least are landowners. What a plague-spot ! Four millions of republican and starving families ! But there is a still deeper sore. It is this—the allotments of land are separated by great intervals from each other. If these four million families held them together, the remedy would be less difficult, though the ailment would still be grievous.

This is the condition, however, to which some of the Irish would-be legislators would ultimately reduce Ireland,—a condition in which, as in the S.E. division of France, for example, the owners of patches of land which are insufficient for the maintenance of their families, naturally look with jealousy upon every proprietor who may possess any thing like an estate.

In both countries we have ample evidence of the ill effects upon agriculture which arise from the minute subdivision of land. If we look to the N.W. division of France, where the average amount of land to each proprietor is greatest, we find the greatest produce of that most important grain, wheat, calculating by the hectare, and in the S.W. the least. In the former the hectare produces, on the average of years, in the ratio of 14 to 9 above that of produce in the latter region; and the other ordinary agricultural crops have a similar superiority in the N. region, which is not to be accounted for by superiority of soil and climate, there being above a third more of calcareous soil in the S.W. division, but by the better means of the farmers, and particularly by their possession of cattle in great numbers to supply manure to the soil,—an advantage which the holder of an acre, or of even 10 acres, cannot command.

The average produce of wheat in France is estimated, at only 23,800,000 quarters on 13,710,000 acres; whereas England, with an inferior climate, produces 15,000,000 of quarters on 5,000,000 of acres.

What but the subdivision of land, creating a race of ignorant farmers without capital, is the cause of the inferiority of production in the two countries? Long may the *aristocracy* of agriculture flourish among us thus !

M. Mounier calculates that there are 43,000,000 hectares cultivated, the remainder being incapable of cultivation, or belonging to the state, or in commonage.

Of those 43,000,000, he supposes that 20,000,000 are farmed by the proprietors, 14,530,000 by the *metayer*, or half-profit system, and the 8,470,000 hectares by tenants at fixed rents, either by single or joint leases.

The metayer system, which prevails much in La Vendée, is one of the most certain evidences of a very backward state of agriculture. The proprietor is either too ignorant of the right principles and practice of husbandry, or too indolent to farm his land, when he leaves the management of it to an uneducated rustic, who is perpetually trying to cheat his employer, and to make the most of the land, without looking to its ultimate condition; and the perpetual vigilance and jealous regard of the proprietor is, on the other hand, galling to the tenant, who, in some cases, must share even fowls, pigs, every thing, with his principal. M. Sousvestre tells an anecdote of a whimsical kind of bargaining which took place in Brittany, between a proprietor and his metayer farmer. A duty pig was required by the former, and agreed to be given by the other; but the question arose, what sort of pig was to be supplied? The notary who was drawing up the article of agreement laid down his pen during the discussion; and while the proprietor insisted on having a fat, well-grown pig, and the other offered but a sucking pig, the man of law decided the matter, by saying, "Well, let it be *un cochon raisonnable;*" and so he entered it in the agreement.

The mode of farming on halves has been one of the principal causes of the deterioration of the soil. The metayer having a greater interest in the secondary productions, which are entirely his own, sacrifices the first to them. He sends his geese and turkeys into his corn fields, because the entire profit of his poultry (of which he is to render no account) seems more beneficial to him than that of half the corn; and he sells his calves at a week old, of which he receives but a part of the price, to avoid rearing them with the milk, which is his own perquisite. He acts in a similar way with the calves which he rears: he weans them too soon, to the injury of their growth; and consequently his horned cattle dwindle and deteriorate continually. The worst of all is, the sale of straw, which, though usually prohibited by leases, is almost a general practice. The consequence is, that the farmer tries to make up for the small amount of the crops which he obtains without dung, and which mostly fail from the exhaustion of the land, and its bad tillage. A great proportion of the farms are ultimately abandoned as totally unproductive, though the ignorance and rapacity of the cultivators have alone occasioned their sterility.

The late M. Dombasle of Roville has added the weight of his experience to the foregoing remarks of M. Chateauvieux and M. de Morogues.

The tenure of the farm should be secured under a fixed rent, otherwise it is impossible that the farmer will apply any capital whatever to its improvement. The lease ought to be for a long term, else the tenant cannot judiciously expend upon it more than a very limited portion of his capital; he would certainly be a fool if he freely advanced his money for improvements which would but increase the value of the land by augmenting its future productiveness. The effect of leases for shares of

the crops is so ruinous from the very nature of the agreement, that if it were possible for this usage to be generally introduced into Flanders or into Alsace, it is indisputable that the soil of those rich provinces would be reduced in a very short space of time, with respect to its productions and value in the market, to a level with the worst cultivated parts of Berry and Poitou ; and conversely there is, in these last provinces, a soil of 300 hectares, so worn out, but naturally fertile, which now brings but an income of 2000 francs to its owner, that might be brought, in less than two years, (by the means which I have pointed out, and by the application of a capital of 150,000 or 200,000 francs,) to let for a rent of 100 francs per hectare ; that is to say, raised to fifteen times its present actual net return.

The tenant-right, or *good-will*, which by the usage of the north of Ireland is marketable between the outgoing and incoming tenant,—and which, in plain English, means a usurped claim of right of possession to the soil by the tenantry—has a perfect analogy to the system of *ill-will*, *mauvais gré*, which has crept into France, as the result of great competition for land and minute subdivision. The Inspectors of Agriculture, in 1843, have thus reported on it :—

The agricultural department of the Nord (in the N.E. region) has still to lament, in the canton of Orchies, a most serious evil. In consequence of a tacit combination among the farmers of the canton—a combination cemented by the dread of almost certain vengeance from those who are directly interested, or their connexions—the proprietors cannot dispose of their lands, either for sale or letting ; they are either obliged to part with them much below the value, or to make terms previously with the occupying tenant, whom they must satisfy at a considerable sacrifice ; the effect of which is that no purchaser, or new tenant, can make an offer for a farm, and that all the properties in this canton fall every day below their real value.

This pernicious custom, rooted in the vicinity of Peronne, (in the department of the Somme) in the district known by the significant term of Lack-land, has existed from time immemorial in the arrondissement of Douai ; it insinuates itself more extensively into the habits of the people, and makes way insensibly into the adjacent communes, which were formerly free from the contagion. Hitherto the measures tried to allay this scourge have been ineffectual : justice is paralysed on one side by the want of any legal mode of compelling the local authorities to have the land of a proprietor, under the ban of 'ill will,' cultivated for him ; on the other, because when a farmer comes forward to complain, there is no chance of prevailing on any witness to give judicial evidence of the crimes or offences of which the former is always the victim.

The wild justice of revenge, however, does not proceed there to the extremities of assassination and arson, as in the practical fulfilment of "good-will!" in Ireland.

M. Rubichon notices the power of the English corporation of agriculturists,—

Which [he says] comprehends the fourth part of the number of British families—say 1,000,000. It possesses and cultivates the soil, and each family enjoys a more real and agreeable life than the other families in the same sphere. In this corporation there are no jealousies among the different classes of it,—no man sighs for that which it is impossible for him to obtain. The farmer thinks it quite natural that his landlord should have his land in perpetuity, as he himself has the ownership of his cattle ; he has even the advantage of extending the number of his live stock, though the farm itself cannot be increased in its limits. He may change his location, too, which his landlord cannot well do. And he has less cause for murmuring at the law of primogeniture than the family of his landlord may have, since the farmer may make any one of his children his heir—a privilege which the other has not, whose eldest son must inherit in spite of him. This corporation is the more com-

bined, too, because its several members live in the country, and have none of the quarrels of society among themselves; and such power, both of action and of opposition, (*inertie*) in particular, that the executive power in England could never have committed itself by such acts of folly as those which we have seen done in France in making railways and building the fortifications of Paris.

Does he not over-estimate the power of the agricultural interest in these days? Again, a short sentence or two,—

France is progressing to the state of Ireland,—while Ireland, awakening from her errors, is advancing to that of England; in short, to trust the subsistence of an empire to unprincipled savages, ruined men, and without talents, is truly an unqualified madness. Hear the suggestions (replies rather) of some of our wiseacres to the Minister of the Interior:—Let France be divided and rated, in the cadastral books, by strips of half a hectare each, and let each be bounded at either end by a hedge, to give FIXITY (*fixity*, just Pat's plan) to the measurement of property; he proposes that each such allotment should be indivisible. In this case France would be rated by *cadastre* in 100,000,000 lots instead of 150,000,000, which is nearly the present amount of the subdivisions.

We cannot quite leave M. Rubichon yet. After referring to the condition of China, where the lands have been measured, valued, and *rated* by the *cadastre*, as in France, he gives the testimony of Lord Macartney and Lord Amherst against the system of extreme subdivision of land.

It hinders the Chinese from having cattle; and food is so scarce, that the law permits the exposure of children at their birth on the banks of canals and rivers;—millions have so perished. And lastly, when the Emperor wished to expel the missionaries, who, in order to bring them up as Catholics, wished to save the infants so exposed, he severely blamed them in his edict for having violated the laws of a country which can only support its existence by such destruction.

The quality as well as the quantity of agricultural productions has been greatly deteriorated in France by the minute subdivision of land. By the returns, taken a few years ago, it appears that the average weight of wheat through France was 61 lbs. per bushel, whereas the present weight is 56 lbs. Now, in England, the reverse has taken place. The oats, in general, are extremely bad. Corresponding deteriorations appear in number and quality of live stock, according as the farms are large or small. In the N.W. and N.E. divisions, where, as we have seen, the average amount of land to each landholder is largest, there were, by the most recent returns published, details which show generally that in the N. a greater portion of valuable live stock is to be found than in the two S. regions conjoined. In the S., indeed, there were, in 1839, eight times more mules, many more asses and miserable sheep, and nearly threefold more *goats*, and a third more of oxen; but the N. moiety of France maintains 316 head of cattle, while the S. has but 270, for every 1000 inhabitants; and though the number of bulls and oxen is less numerous in the N. than in the S. division, there is a much larger proportion of cows and calves in the former. And to counterbalance the numerical superiority of oxen (for labour) in the S. division, there are in the N. more than three times the number

of horses, mares, and foals collectively; yet, though there are nearly three millions of horses in the country, she imports annually 37,000 for her country, from the deficiency in quality of the native race for cavalry service. There are but 32 millions of sheep in France, and they are generally wretched animals, and weigh, on an average, but 30 lbs. each. Where flocks used to abound, there are now none; a few starved couples here and there, tied together, and kept for the sake of the wool by the peasantry, are the representatives of their race. The number of pigs is nearly equal in the N. and S. divisions, taken together, but much greater in either of the N. divisions, compared with the S.E. division, individually. But the total number in continental France is less than 5 millions; and they are generally a miserable breed, worse, if possible, than the genuine Irish pig thirty or forty years ago. Comparing, then, the N. of France, where subdivision prevails in a lesser degree, with the S., where it prevails more, we may say that the N. is more rich in cows, calves, horses, mares, and foals; whereas the S. is more rich in bulls, oxen, rams, wethers, ewes, lambs, swine, goats, mules, and asses. But number and quality should be considered, to form an accurate judgment; for a great number of animals, of inferior races, may not be equivalent to a smaller number of more valuable kinds. We examine the prices, and we find the average price of a bull to be 84 fr. in France—80 fr. in the N., and 84 in the S.; that of an ox 153 fr. in France—149 fr. in the N., and 159 fr. in the S.; of a cow 89 fr. in France—92 fr. in the N., and 82 fr. in the S.; and we find that the price of a bull is less than that of a cow, whereas, if breeding were understood, the value of a bull would be 8 or 10 times more than that of a cow. In Normandy, however, there are many very splendid cattle; and some of the little cows of Brittany are exported to England every summer and sold as Alderneys. The average price of a wether sheep in France is 4 fr. 45 cent.; in the N. 5 fr. 95 cent., in the S. 3 fr. The price of horses varies very considerably.

It is refreshing to glance at Mr M'Queen's statistics of the British empire after the foregoing statements, and compare them with the French returns. In the British empire there are, according to M'Queen, 2,250,000 horses — value, £67,000,000. In France, 2,801,667—value about £9,000,000, or one-fifth of the value of the horses used in British and Irish agriculture alone. The number of horned cattle in the British empire is about 15,000,000—value £216,000,000. The number in France 9,883,050—value about £13,000,000. The number of pigs, of all ages, in the British empire is calculated, by the same authority, to be 18,000,000; which, taking one-third at £2 each, and the remainder at 10s. each, gives a total value of £11,875,000; whereas the total value of the swine in France is less than £5,000,000.

Of these facts M. Rubichon is very sensible. He says,—

In England, the differences in quality have no limitations; for if there are such calves or lambs, which sell for a trifle when they are dropped, there are others which sell for 100 francs. Agriculture in England is so organised, especially within twenty years, that farmers are continually substituting those of high value for those of inferior worth. While the other European agriculturists are at a stand in this respect, or rather allow their live stock to deteriorate, it is easy to foresee that, twenty years hence, the wealth of each country in Europe will have so decreased, and that of England so increased, that there will be no more comparison to make.

Even our 18,000,000 of pigs might be increased by the general introduction of green crops and garden husbandry into Ireland and the Highlands of Scotland. In the latter part of the empire, the rearing of pigs, until within a recent period, was greatly neglected, as the natives had a sort of religious prejudice against the use of pork. A gentleman, well known to the writer, when reasoning with an old Highland peasant on the absurdity of this prejudice, was answered,—"It may a' be very true, sir, but I canna thole to eat ony thing that the deil has been in." By the exertions, however, of the proprietors, this prejudice is fast wearing away, and the revenue now derived by the export of swine from the Highlands of Scotland is becoming a very considerable item in her productions. The wife of the old man who objected to eat pork having been persuaded to keep one for other people to buy and eat it, declared, after selling the animal, that pigs were fine animals, and better "nor a coo." She had received £4 for a pig that had only cost her 7s. a year before, and had been fed on offal, on which other animals would have starved.

Great Britain, compared with France, has made wonderful advances in every department of agriculture, yet still there is a vast deal to be done, because, as in France pre-eminently, there is yet with us a great breadth of soil to be drained and deeply ploughed and subsoiled, by which the productions of all kinds will be vastly increased. In France, such improvements cannot take place, unless its whole system, as to the subdivision of land by inheritance, be altered. The ground cannot be left without a crop by a poor man for a time sufficient to drain and otherwise amend the condition of the soil, as an English farmer can afford to do. The Frenchman lives from hand to mouth. Though he wastes seed, and is penny-wise in not applying labour in hoeing and weeding, he will not alter his wretched system, nor, indeed, has he the practical models before him which stimulate the British husbandman of low degree. There are very few French country gentlemen to show him a good example,—they congregate in towns,—and such is the national dislike of the gentry to the solitude of a country life, that one of the authors under our review seems to take it for granted that none but corporations of ecclesiastics, as of old, could carry on a system of uniform and effective rural improvements on the soil. He attaches great importance to the past labours and skilful practice of monks, dissociated from social life, and we believe that he would willingly re-

vive them. Unquestionably, the superior education of the churchmen of old, among the multitude of ignorant men, had a prodigious influence in advancing agriculture in France, as in Great Britain and Ireland; and whether it was that their greater knowledge led them to select their lands well, or to cultivate them well, we cannot decide, but it is a fact, that the old church lands are the best, and that any intelligent man having the choice between two farms, without seeing either of them, would select that which commences with the Celtic *kil*—burial-place—in preference to that which begins with *bal*—town-land,—if those words happened to designate the two farms.

The work shows that the great amount of food which gives support to the people is the produce of gardens. The Minister of the Interior cites this as indicative of the advance of agriculture; but M. Rubichon maintains that it proves that Frenchmen are retrograding to the food of cattle—*legumes secs* and sallads are miserable food for men, in his estimation. So they would be, but for the quantity of bread consumed with them. From want of domestic animals, however, and consequently from the want of animal food, milk, and butter, the peasant population in the S. E. region, more particularly, is reduced to a state of degradation similar to that of the most wretched of the Irish peasantry and Scotch Highlanders. Yet what a lesson may be derived by these poor people, regarding the value of a garden! In the portion of France to which we have last referred, where subdivision is extreme, every allotment is in fact a garden. Yet the Frenchman contrives to extract from such patches the means of subsistence for himself and his family.

The prejudices of the old are, however, so difficult to be overcome, that it is with the young only our labours will be really effective. Here the schoolmaster comes to our aid; but a schoolmaster different from the class yet introduced generally among our rural population. Even in Scotland, where schoolmasters of a superior kind are to be found, ignorance and prejudice prevail all over the Highlands, with a great aversion to innovation and change of system, as much so in garden husbandry as in field culture. Where gardens are to be found in the Highlands, their produce is but Riga kale and early potatoes; no French beans, no onions, no peas, no beans, no early cabbages, no carrots, not even a turnip. So is it, also, throughout Ireland generally, among the common farmers and peasantry. And how are such prejudices and omissions to be overcome? By the introduction of industrial schools, in which the young of both sexes may be taught to compound a midden, and to make drains, and learn the uses of draining; taught also to sow the land, at the proper periods, too; instructed in the mode of growing, pruning, and training fruit trees, and led to the knowledge of the various pro-

ducts of the soil, and allowed to partake of the fruits which they raise. The female pupils in those industrial schools should learn to cook and prepare a meal, something more than the mere boiling of a potato. They should be taught the value of the refuse of a garden in feeding a cow or a pig. They should learn to sow, and make their fathers' and brothers' shirts. In our Highlands the great majority of country girls are deficient in this branch of female education. The curing of bacon, making of hog's puddings and sausages, is another accomplishment which they should learn; for it is not enough for them to know how to keep a hog, and to mark and accelerate the advance which it makes in flesh. Without such general education for the rural population of the empire, we cannot expect to keep in advance of France, and other countries of the Continent, where agriculture may now be backward; because an impulse will assuredly be given to them, as it has been recently to Scotland, where those grand preliminaries, draining and subsoiling, are now objects of extreme attention.

Our two French authors, whom nothing important seems to have escaped, remark that Mr Smith has "perfected a system of draining known from time immemorial," and some of the consequences are, that cattle which formerly were fattened at pasture, at the rate of from 100 to 120 lbs. in the course of a year, will on the drained land increase from 100 to 150 lb. in eight months; and wheat, which formerly yielded but tenfold for the seed, now produces thirty and forty fold, under Mr Smith's system. On another occasion we shall, perhaps, review the second volume of this most interesting work. For the present we conclude with this gratifying prophecy of our future progress:—

> It is now that the discoveries of Bakewell are in full operation. There are in Great Britain many hundred farmers who, emulating each other, apply and limit their industry to the breeding and improvement of bulls and rams, for the purpose of hiring them out to other farmers to increase their stock. The ox and the sheep constitute the most considerable portion of the wealth of a country, not only by their number and weight, but by the quantity of fat and the quality of manure which they produce. The richest country is, therefore, that which produces the greatest amount of fat food. And we have already seen that Great Britain, at this day, produces four times more fat now than she did fifty years ago; and fifty years hence she will produce four times more than now, if she does not exceed this ratio.

THE RATIONALE OF THE APPLICATION OF SPECIAL MANURES.

By Mr Thomas Rowlandson, Liverpool.

The term special manure is applied to those substances which act as fertilisers, though used in small quantities,—a dressing of 3 cwts. per acre being deemed, on an average, a sufficient dressing. This name is given in contradistinction to ordinary manures, viz., farm-yard manure, night-soil, varied composts, lime, &c. Special manures were unknown prior to the introduction of

bones as a means of promoting fertility; and these, in the first instance, were lavishly used, a hundred bushels per acre being frequently applied at their early introduction. As their value became more appreciated, their price rose accordingly, and they consequently became more sparingly used; until at last, by the aid of sulphuric acid, forming the super-phosphate of lime, eight bushels have been deemed by competent judges, after numerous carefully made experiments, amply sufficient to manure an acre of ground. The economy of manures, at all times a vital question with the agriculturist, has, at the present moment, peculiar claims on his attention, as he will speedily have to compete with the foreign producer on equal terms, there remaining to the British farmer no other protection than the advantages derived from a contiguity to the market, and such as he may obtain by skill and exertion. The former he will always retain. Of the variety of matters which come under the denomination of the latter, it will eventually be found that the improvement in the nature and proper application of special manures will hold the most prominent place. With the object of drawing the attention of agriculturists to the importance of the subject, this paper is written. Prior to the appearance of Baron Liebig's work on chemistry, and its application to physiology and agriculture, manures were applied in a manner the most empirical. In the work alluded to it was, however, declared that "*the theory of manures consisted in applying to the soil those inorganic constituents which are contained in the ashes of the plants intended to be grown,—nitrogen, or nitrogenous substances, in the form of nitrates, or ammonia, and its salts, were also presumed to have a considerable influence on the fertility of soils.*" The learned chemist has, however, in some degree, recently retracted that part of the theory which relates to the application of nitrogenous substances, stating that, if the inorganic constituents of a given crop are applied to the soil in sufficient quantity, the nitrogen can be derived from the atmosphere. It must be admitted that all experience disproves this latter position; and it cannot be doubted that no manures can be properly compounded without the aid of substances containing nitrogen. To an agriculturist acquainted with chemistry, and thoroughly convinced of the truth of the axiom that, in order to ensure good crops, it is only requisite to apply substances fit for assimilation by, and containing the inorganic elements of crops, combined with a due proportion of nitrogenous matter, to ensure permanent fertility, it is most painful to peruse the recorded experiments which have appeared from time to time in *The Transactions of the Highland and Agricultural Society of Scotland*, and *The Journal of the Royal Agricultural Society of England*,—experiments made most empirically. Though it is due to the experimenters to state, that they have invariably been conducted with a great expenditure of toil, time, and money, it is only with the injudicious selection of the materials that I have to complain. They

are, however, so far valuable as beacons to succeeding observers, whether as it regards the shoals which he should avoid, or as indicators of the correct course which he should follow. It is peculiarly gratifying to find, after a most attentive, careful, and laborious perusal of the numerous recorded experiments in the journals alluded to, that such special manures as are composed of materials the nearest to the theory propounded by the chemist, are those which, under a given set of circumstances, are the most productive of fertility. The deviations are few, and such as, in many instances, may be easily accounted for by circumstances which have probably escaped the observation of the experimenter; an instructive lesson to the merely *practical* farmer. Prior to reviewing the numerous published experiments on special manures, it will be well to take a review of the present state of chemical science as applied to practical agriculture. The opinions held by the earlier chemists were that, by some unknown process, water and air were assimilated by the vital powers of plants, from which combination their sap and other juices were formed. The carbon was supposed to be derived from the earth, until the experiments of Kirwan showed that such could not in fact be the case. The celebrated Dr Priestly of Birmingham was the first to show that growing plants absorbed carbonic acid from the atmosphere by their leaves, whilst exposed to the solar rays, and evolved oxygen; from which it was inferred that the carbon of the carbonic acid was assimilated by the plants to form the ligneous fibre, and other parts of the plant into which carbon entered as a constituent. The opinion here expressed respecting the assimilation of carbon by plants, by the absorption of carbonic acid from the atmosphere through their leaves, and subsequent assimilation of carbon and evolution of oxygen, is that held by all chemists of eminence. Up to a recent date it was generally maintained that the carbon of plants was obtained from the soil, and from organic manures, such as ordinary farm-yard manure, and the benefit derivable from the use of old and well fermented manure was presumed to arise from the fact that such manure was in a better prepared condition to yield its carbonaceous matter to plants; whereas the fact is, that during the fermentation of manure a large portion of its weight is lost, being evolved in the form of carbonic acid and water, to say nothing of the valuable azotised matters which escape at the same time. During such fermentation none of the inorganic constituents of the plants, excrements, &c., which usually compose farm-yard manure, are lost, provided proper care be taken, (which, however, is not the case at one farmstead in 20,000;) consequently, if a heap of manure, freshly accumulated, loses one half its weight in being well fermented, it will be seen that its value is doubled as regards the inorganic or mineral constituents of the plants, &c., which composed it originally. On this, together with the fact that fermented manure is in a more finely divided

state, depends the circumstance of the superior fertility of well fermented manure; in other words, fermented manure approaches nearer a special manure, in having the mineral matters composing plants in a more concentrated, and at the same time more finely divided state, and of consequent easier adaptation for absorption by plants. It is only within the last half century that the manipulations of chemistry have been so improved as to make us aware of the very important part which a few minerals play in the course of vegetation: in fact, the ashes of plants other than the carbonaceous ones, until recently, had been entirely overlooked; and this might well be the case, seeing that the mineral matters formed so minute a portion of the plant. As an instance, I may give the analysis made by Professor Way of Laing's self-preserving swede, which, on an estimated produce of 12 tons bulbs, and 1 ton 16 cwt. tops, the per-centage of water and ash was found to be as follows:—

	Water.	Ash.
Bulbs . . .	87·7	·79
Tops	86·0	1·88

Seeing, therefore, that 100 lbs. of the bulb (the most important part of the plant, and consequently most likely to be first examined,) did not contain more than three quarters of a pound of mineral ash, we cannot be surprised that the earlier inquirers overlooked its importance; and our surprise will be still more diminished, when informed that the above described ¾ lbs. of mineral matters consisted of the following constituents, viz.,—

about	30	per cent of	Potash.
...	10	...	Phosphoric acid.
...	10	...	Sulphuric do.
...	10	...	Carbonic do.
...	10	...	Lime.
...	10	...	Chloride of sodium, (common salt.)
...	20	...	Magnesia, soda, silica, peroxide of iron, &c.
	100		

Potash was the only substance suspected to be present, and was therefore called the vegetable alkali, in contradistinction to natron, (carbonate of soda,) which was named the mineral alkali.

Recent analyses, made by the most eminent chemists, and conducted with the greatest care, show that particular plants *invariably* contain the above mineral constituents, and that in proportions sufficiently alike to prove that they exist in pretty nearly determinate proportions as regards the bulk of the crop, irrespective of the manures employed, whether organic or inorganic, on rich or poor soils, manured or unmanured; any perceptible variation appears generally to be affected by the abundance or paucity of azotised matters present.

In taking a view of special manures, as respects the quality and quantity of ingredients which should be applied to a particular crop, the first inquiry that arises to a scientific agriculturist is, *What are the mineral constituents?* and the quantities of each description removed by a crop, in order that the soil may be left in the same

normal state of fertility as it existed when the seed was sown. In order that this subject may be better understood, the following tables of the analyses of various crops are given, viz. :—

POTATOES.

AVERAGE COMPOSITION of the Ash of the Potato Tuber, as given by P. T. H. Fromberg, in the Prize Essay on the Chemical Composition of the Potato, published in the Highland Society's Transactions for March 1847 :—

	Calculated without carbonic acid.	Calculated with carbonic acid.
Potash	43·18	52·40
Soda	3·20	3·88
Lime	1·80	2·20
Magnesia	3·17	3·85
Oxide of iron	0·44	0·53
Sulphuric acid	15·24	18·50
Phosphoric acid	8·61	10·45
Chlorine	4·81	5·84
Silica	1·94	2·35
Carbonic acid	18·29	...
	100·68	100·00

PROPORTION OF WATER, OF ORGANIC AND INORGANIC MATTER IN THE POTATO TOP, (from the same authority.)

In the Stem.		Cold dry.	In the Leaves.		Cold dry.
Water	89·73	...	Water	85·22	...
Organic matter	8·49	82·67	Organic matter	12·51	84·55
Inorganic matter	1·78	17·33	Inorganic matter	2·27	15·45
	100·00	100		100·00	100·00

COMPOSITION OF THE ASH OF POTATO TOPS, (from the same.)

	White Buffs.		Red Buffs.	
	Stems.	Leaves.	Stems.	Leaves.
Potash	31·15	17·27	35·32	18·63
Soda	5·80	...	3·78	4·58
Chloride of potassium	...	4·98	...	19·72
do. sodium (common salt)	21·60	14·85	21·03	2·39
Lime	19·13	26·98	20·24	26·09
Magnesia	5·09	6·04	4·39	4·59
Oxide of iron	1·43	3·70	1·34	3·50
Sulphuric acid	5·56	5·76	6·02	7·99
Phosphoric acid	6·90	14·94	5·51	9·29
Silica	3·34	5·48	2·37	3·22
	100.00	100·00	100.00	100·00

For farther particulars respecting the composition of the ash of the growing crop at successive stages, I must refer the reader to the valuable article alluded to.* From the preceding detailed and other experiments, Fromberg concludes that a ton of artificial manure (composed only of the mineral ingredients) for the potato crop, should be proportioned as follows:—

Potash	1180 lbs.	Sulphuric acid	416 lbs.
Magnesia	87	Phosphoric acid	235
Soda	77	Chlorine,	195
Lime	50		
			2240

To the practical use which may be made of the above analyses and calculations I shall advert hereafter. I shall now proceed to give the analyses of the most important and usually cultivated plants, viz:—

MESSRS WAY AND OGSTON.	Hopeton Wheat. Grain.	Hopeton Wheat. Straw and Chaff.	Chevalier Barley. Grain.	Hopeton Oats. Grain.	Potato Oats. Grain.	Rye Grain.
Per-centage of ash	1·94	5·8	2·5	2·5	2·73	1·60
Silica	5·63	69·36	32·73	38·48	50·03	9·22
Phosphoric acid	43·98	5·24	31·69	26·46	18·87	39·92
Sulphuric acid	0·21	4·45	0·79	1·10	0·10	1·17
Carbonic acid	...	...	...	...	...	...
Lime	1·80	6·96	1·48	3·54	1·31	2·61
Magnesia	11·69	1·45	7·45	7·33	8·25	12·81
Peroxide of iron	0·29	0·73	0·51	0·49	0·27	1·04
Potash	34·51	11·79	20·77	17·80	19·70	33·83
Soda	1·87	...	4·56	3·84	1·35	0·39
Chloride of sodium	...	...	...	0·92	0·07	...
	99·98	99·98	99·98	99·96	99·95	99·99

COMPARATIVE VIEW of the Mineral Matters contained in one ton of Turnips, Mangold Wurtzel, and Carrot—the average of analyses (about 50 in number,)

BY PROFESSOR WAY.	In one ton of the bulb. Turnip	Mangold	Carrot	In one ton of the top. Turnip	Mangold	Carrot	In one ton of the entire plant. Turnip	Mangold	Carrot
Silica	0·34	0·54	0·24	1·73	0·76	4·46	0·55	0·56	1·22
Phosphoric acid	1·77	0·66	1·73	2·60	1·94	1·64	1·90	0·87	1·63
Sulphuric acid	2·33	0·65	1·31	3·46	2·20	5·61	2·51	0·90	2·37
Lime	1·76	0·41	1·77	11·29	3·51	30·24	3·76	0·87	8·21
Magnesia	0·47	0·43	0·81	1·16	3·27	2·58	0·59	0·89	1·19
Peroxide of iron	0·07	0·12	0 22	0·72	0·52	2·36	0·18	0·15	0·73
Potash	6·07	4·99	6·59	6·08	7·86	6·64	5·84	5·54	5·60
Soda	1·46	3·02	2·71	1·12	2·52	9·67	1·38	2·91	4·33
Chloride of sodium	1·49	5·29	1·42	6·15	12·82	11·95	2·37	6·51	3·55
Chloride of potassium	...	...	...	2·02	...	...	0·53	...	...
	15·76	16·11	16·79	36·33	35·20	75·15	19·61	19·20	28·83

* *Transactions of the Highland and Agricultural Society* for March 1847, p. 693.

COMPARATIVE VIEW of the Composition (in 100 parts) of the ash of Turnip, Mangold Wurtzel, and Carrot,—the average of analyses :—

BY PROFESSOR WAY.	Bulb.			Top.		
	Turnip.	Mangold.	Carrot.	Turnip.	Mangold.	Carrot.
Average per cent of ash	0·79	0·88	0·90	1·63	1·7	4·12
Silica	1·81	2·57	1·19	3·99	1·99	4·56
Phosphoric acid	9·85	3·08	8·55	6·17	5·15	1·67
Sulphuric acid	13·12	3·37	6·55	8·43	5·80	6·20
Carbonic acid	11·96	18·32	17·30	9·98	6·49	17·82
Lime	9·93	1·95	8·83	28·49	8·65	32·64
Magnesia	2·61	2·11	3·96	2·81	8·66	2·92
Peroxide of iron	0·46	0·60	1·10	1·68	0·96	2·40
Potash	34·10	24·79	32·44	15·21	21·26	7·12
Soda	7·96	13·75	13·52	2·84	7·01	10·97
Chloride of sodium	8·13	29·41	6·50	15·30	33·96	13·67
Chloride of Potassium	...	...	...	5·04	...	...
	99·93	99·95	99·94	99·94	99·93	99·99

TABLE OF MINERAL MATTERS removed by the Grain, Straw, and Chaff of an acre of Wheat, calculated at 28 bushels of 61 lbs. per bushel.

	Mineral matters in 100 parts of straw ash.	Mineral matters in 100 parts of chaff ash.	In a ton of straw.		In a ton of chaff.		Removed from an acre. In 28 bushels of grain at 61 lbs per bushel. (1792 lbs.)		Removed from an acre. In 2109 lbs. of straw and chaff, 18 cwt. 19 lbs.	
			lb.	oz.	lb.	oz.	lbs.	oz.	lbs.	oz.
Silica	63·89	81·22	60	...	172	3	1	$0\frac{6}{10}$	83	8
Phosphoric acid	2·75	4.31	2	8	9	2	12	13	7	3
Sulphuric acid	3·09	...	2	14	...		0	$1\frac{5}{10}$	3	12
Lime	7·42	1·88	7	0	4	0	1	$0\frac{3}{10}$	7	1
Magnesia	1·94	1·27	1	13	2	11	3	$8\frac{13}{10}$	2	13
Peroxide of iron	0·45	0·37	0	6	0	14	0	$3\frac{6}{10}$	0	10
Potash	17·98	9·14	17	0	19	6	8	15	13	15
Soda	2·47	1·79	2	5	3	12	0	$12\frac{3}{10}$	0	13
	99·99	99·98	93	14	212·0		28	$6\frac{6}{10}$	119	11

From the same authority, Professor Way, in the analyses of plants published in the *Journal of the Royal Agricultural Society of England*, from which valuable publication the above and several of the succeeding analyses are taken, we are informed that with regard to barley and oats, deducting silica, their mineral constituents closely resemble those of wheat, the ash of barley giving 2·28 per cent of ash, of which 0·74 per cent was silica, leaving 1·51 per cent for other substances. In 100 parts of this ash we should have by calculation—

Phosphoric acid,	47·10	Potash,	30·80
Magnesia,	11·00	Soda,	6·83
Lime,	2·20		

The ash of oats, making the deduction of the silica contained in 100 parts.

Phosphoric Acid,	43·0	Potash,	28·0
Magnesia,	17·0	Soda,	3·0

COMPOSITON of the ASH of BEANS and PEAS grown on Chalk or Clay.

BY PROFESSOR WAY.	PEAS.		BEANS.	PEA STRAW.		BEANS.
	On chalk.	On clay.	On clay.	On chalk.	On clay.	On clay.
Per-centage of ash,	1·97	2·25	2·37	7·52	7·96	4·97
Silica	1·76	0·84	0·42	2·53	1·94	2·61
Phosphoric acid	24·20	28·85	28·72	1·31	1·23	0·49
Sulphuric acid	4·70	5·85	3·05	1·85	2·96	1·40
Carbonic acid	3·18	2·12	3·42	30·33	29·03	25·32
Lime	6·97	4·55	5·20	46·92	36·46	19·85
Magnesia	6·66	6·96	6·90	8·36	5·73	2·53
Peroxide of iron	0·25	trace.	trace.	1·14	0·73	0·61
Potash	44·02	41·50	51·72	3·87	12·68	32·85
Soda	...	5·02	0·54	1·86	0·24	2·77
Chloride of Sodium	8·23	4·33	...	1·76	9·66	11·54
Total	99·97	99·99	99·97	99·93	99·96	99·97

COMPARISON of MINERAL MATTER in BEANS and PEAS, both on Clay Soil.

BY PROFESSOR WAY.	One ton of peas.	One ton of beans.	2989 lbs. of pea straw.	2270 lbs. of bean staw.	Entire crop of peas.	Entire crop of beans.
Silica	0·42	0·22	4·62	2·95	5·04	3·17
Phosphoric acid	14·43	15·23	2·93	0·55	17·36	15·78
Sulphuric acid	2·93	1·62	5·38	1·58	8·31	3·20
Lime	2·28	2·75	86·80	22·25	89·08	25·00
Magnesia	3·48	3·66	13·62	2·85	17·10	6·51
Peroxide of iron	...	...	1·74	0·69	1·74	0·69
Potash	20·75	27·40	30·19	36·96	50·93	64·36
Soda	2·51	0·28	0·57	3·13	3·08	3·41
Chloride of sodium	2·15	...	23·00	13·88	25·15	13·88
	53·15	51·16	168·84	84·84	207·79	136·00

A special manure adapted to grow a crop of beans and peas ought to be composed of the above matters, and in the proportions set forth in the two last columns.

To supply the mineral ingredients to an acre of potatoes of say 12 tons of tubers, we ought to furnish the soil with at least the following quantities of the articles named hereafter, viz.:—

Potash	150 lbs.
Soda	12 „
Lime	9 „
Magnesia	20 „
Sulphuric acid	60 „
Phosphoric acid	33 „
Chlorine	18
Total	202

Twenty tons of bulbs and four tons of tops per acre of the following roots would require to be supplied with

	Turnips. lbs.	Mangold Wurtzel. lbs.	Carrots. lbs.
Phosphoric acid	45	21	39
Sulphuric acid	50	22	57
Lime	90	21	197
Magnesia	14	22	29
Potash	140	133	134
Soda	33	70	103
Chloride of sodium	57	160	85
Total	429	449	644

An average crop of wheat (which may be taken as the type of the cereals,) will remove per acre in mineral ingredients in the grain, straw, and chaff—

Silica	84	lbs
Phosphoric acid	20	„
Lime	8	„
Magnesia	6	„
Peroxide of iron	1	„
Potash	23	„
Soda	1½	„
Total	143½	

Having shown what is commonly termed the exhausting powers of the greater number of our usually cultivated crops, I shall proceed to examine whether the special manures usually employed are such as to fairly entitle us to anticipate fertilising effects from their application. I will commence with the super-phosphate of lime, which has recently become such a popular dressing. Super-phosphate of lime is formed by adding muriatic or sulphuric acid (usually the latter) to bones; now bones consist of—

Organic matter (gelatine, &c.)	35	per cent.
Phosphate of lime	55	„
Phosphate of magnesia	2	„
Carbonate of lime	6	„
Soda, salts, &c.	2	„
Total	100	

The usual and most approved mode of preparing super-phosphate of lime is to pour an amount of sulphuric acid, specific gravity 1·80, equal to one half the weight of the bones to be decomposed, diluted with twice its own weight of water, by which about 20 per cent of the phosphate will be converted into super-phosphate. Provided the above proportions are adhered to,

the composition of the so-called super-phosphate will consist as follows, viz.:—

Phosphate of lime in the state of phosphate and super-phosphate	35	per cent.
Sulphate of lime (gypsum)	20	„
Animal matter	20	„
Water, carbonised animal matter, &c.	20	„
Total	100	

The quantity of animal matter in 100 lbs. of dry bone will produce about 6 lbs. of ammonia, or equivalent to 4 per cent in the super-phosphate. In applying 100 lbs. of superphosphate we supply 20 lbs. of phosphoric acid, 15 lbs. of sulphuric acid, 20 lbs. lime, and 4 lbs. of ammonia, with minute portions of magnesia, &c. If, however, we refer to the preceding tables, it will be found that potash preponderates as a mineral ingredient in all the crops, for which no provision is made when we only supply the crop with super-phosphate of lime. It is quite true that amazing effects have been produced by the use of super-phosphate; but in all such cases the potash has been supplied by the soil, to the detriment of succeeding crops. This may not be made apparent the first few years, but the time will arrive when an application of super-phosphate will cease to have the desired effect; and this will be the sooner apparent on sandy and turfy soils. In such cases the farmer will most probably exclaim, that the land is sick or tired of super-phosphate of lime, whereas the fact is, the infertility will be caused by the exhaustion of the available or active potash.* Similar remarks apply to the use of guano, which I shall dismiss with the observation that, in a given quantity of guano we do not apply quite so much phosphate of lime as in the super-phosphate, but a much larger amount of ammonia, and no sulphate of lime. The greater benefit derived from the use of super-phosphate of lime and guano over ground bones arises from the fact of the phosphate of lime in the two first-named articles being more finely divided than in the last, and also to the circumstance of guano containing a large amount of azotised substances, which are gradually converted into ammonia. The fact ought never to be lost sight of, that all the super-phosphate of lime is speedily converted into the neutral phosphate of lime by the carbonate of lime existing in the soil; so that the greater solubility of this substance, other than as a finely divided powder, exists only for a short period. The object in writing this paper is to convince farmers that, in order to compose a special manure whose effects shall be as certain as farm-yard manure, we must form them of all the mineral ingredients required by the crop intended to be grown. In

* Dr Daubeny has judiciously divided the mineral ingredients in soils which are serviceable to growing crops into active, potential, and dormant. Good husbandry consists in converting the two latter into the former.

order the more fully to understand the theory respecting special manures here set forth, let us examine the composition of farm-yard manure. The first analysis I shall notice is one by Mr Richardson, inserted in *The Philosophical Magazine*, which was made on farm-yard manure, taken just previous to being applied, and was found to consist as follows:—

	Fresh.		Dried at 212°.
Water . .	64·96	Carbon . .	37·40
Organic matter .	24·71	Hydrogen .	5·27
Inorganic salts .	10·33	Oxygen . .	25·52
		Nitrogen . .	1·76
	100·00	Ashes . .	30·05
			100·00

Inorganic matters.

A. Portion soluble in water.			B. Soluble in muriatic acid.		
Potash .	3·22		Silica . .	27·01	
Soda . .	2·73		Phosphate of lime .	7·11	
Lime .	0·34		Phosphate of magnesia	2·26	
Magnesia .	0·26		Phosphate of iron .	4·68	
Sulphuric acid	3·27		Carbonate of lime .	9·34	
Chlorine .	3·15		Carbonate of magnesia	1·63	
Silica . .	0·04		Sand . .	30·99	
		13·01	Carbon . .	83	
			Alkali, and loss .	3·14	
					86·99

A. Portion soluble . .	13·81
B. Ditto insoluble . .	86·99
Total . . .	100·00

The other analyses which I shall quote are those published by Mr Nisbit, as having been made by his pupils, Messrs Allen and Greenhill.

	Farm-yard Manure from Kent.	Farm-yard Manure from Surrey
Per-Centage of Ash . . .	9·2	9·6
Silica	79·79	71·32
Potash	3·32	5·14
Soda	0·92	1·68
Lime	6·90	12·32
Magnesia	0·56	0·82
Common salt	1·43	1·22
Phosphate of iron	2·04	2·03
Phosphate of alumina	1·53	2·54
Sulphuric acid	1·89	1·57
Phosphoric acid	1·58	1·27
Manganese	a trace	...
	99·76	99·91

With reference to the constituents of the above manures, as also with regard to the composition of special manures, I shall not dwell upon the following articles, viz.—silica, soda, lime, magnesia, salt, chlorine, &c., as they can be procured in abundance and cheap; or else, as in the case of magnesia, the amount required by an acre is so small as to form a very trivial portion of their economical estimate, and may easily be procured as Epsom salts, &c. The leading substances, as regards cost and quantity, are potash and phosphoric acid. Sulphuric acid is comparatively inexpensive, as it can be easily and cheaply obtained as sulphate of lime (gypsum). Common salt is a cheap source of supply for chlorine and soda; silica generally exists in soils sufficiently abundant for the wants of the cereals. If a soil is found deficient of this article, it can be cheaply supplied by silicate of soda or potash, manufactured for the purpose.

In reviewing the preceding analyses of farm-yard manure, we discover that something like 70 per cent consists merely of water, 20 per cent of organic matter, principally ligneous fibre, and 10 per cent of inorganic substances, of which latter nearly 70 per cent consists of sand, (silica, the exterior covering of straw.) Farm-yard manure contains, on the average, 0·5 per cent of ammonia, of which more will be stated hereafter. The only scarce, and consequently expensive, inorganic matters existing in farm-yard manure are potash and phosphoric acid. If we assume for our data that ordinary farm-yard manure contains 10 per cent of inorganic matter, there will exist 224 lbs. of the same in one ton, 2240 lbs in 10 tons, and 4480 lbs. in 20 tons. If we now assume that of the above quantities potash and phosphoric acid exist respectively in the proportion of 3½ per cent, it follows that there will be present in every ton of farm-yard manure 7·82 lbs. of each, in ten tons 78·2 lbs. do, in 20 do. 156·4 lbs. do., or more potash than would be required by 20 tons of turnips, mangold wurtzel, or carrots respectively, and upwards of three times the amount of phosphoric acid required for the same weight of turnips, nearly eight times the weight assimilated by 21 tons of mangold wurtzel, and four times the amount required by an equivalent quantity of carrots. I have not, neither do I intend to advance any thing respecting the part which the organic portion of the manure plays, other than the azotised matters contained therein, being firmly convinced that its fertilising properties consist mainly in its great hygroscopic power, together with its strong tendency, in which it is similar to carbon, of retaining the ammoniacal and fixed salts of the manure, and probably also by its decomposition as a slow source of carbonic acid. The intelligent agriculturist must clearly perceive, from the numbers respectively given in the preceding tables, both as regards the composition and proportions of the mineral constituents of plants and farm-yard manure, that when he applies 20 tons of manure (farm-

yard) to a crop of Swede turnips,* that, so far as phosphoric acid is concerned, he need only have applied 6 tons, and the deficiency of potash might have been supplied by mixing with the 6 tons 2 cwt. of sulphate of potash, 1¾ cwt. of carbonate of potash, or 2¼ cwt. of nitrate of potash (saltpetre), the latter would also supply nitrogen; quantities of salt, gypsum, Epsom salts, &c., can be proportionately added. This is the true rationale of applying special manures in connexion with farm-yard manure; and such agriculturists as will be induced to follow such a system, will find their profitable account in doing so, as it will greatly extend their command of manure.

It remains to be shown whether, irrespective of resorting to the manure-heap, can special manures be profitably applied, and with equal certainty of success, under a given set of circumstances. The answer is clearly in the affirmative. Before giving my own opinion on this point, I will quote some recipes given by other, and at the same time better known, authorities. In doing so, I wish to observe that all the recipes which I have seen given for special manures, with the exception of one which I proposed at the Northampton meeting of the Royal Agricultural Society of England in July last, are objectionable, in consequence of their containing elements which are incompatible, and such that the materials formed by the double decomposition of their constituents could be obtained more economically by purchasing them in a state that would not be obnoxious to change.

Professor Way says, (*Journal of the Royal Agricultural Society*), "The total phosphoric acid of the wheat crop would be furnished in ¾ cwt. or 1 cwt. of unburnt bones; the magnesia by 40 lbs. sulphate of magnesia (Epsom salts): and the potash by about 35 lbs. of carbonate of potash (pearl ash), or 50 lbs. nitrate potash (saltpetre); but this last addition will be unnecessary if silicate of potash be employed—the necessary top-dressing will be"

2¼ cwt. of silicate of potash.
1 cwt. of crushed bones.
40 lbs. of sulphate of magnesia.

Taking into consideration, however, the very gradual solution of the phosphate of lime of bones, it would, no doubt, be better to adopt another form of top-dressing for wheat. The following (he says) would perhaps be a better application:—

2 cwt. of silicate of soda.
1 cwt. of bones dissolved in
½ cwt. of oil of vitriol.
40 lbs. of sulphate of magnesia (Epsom salts,) and
35 lbs. of carbonate of potash.

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* Except on remarkably good land, in fact those finely divided open soils, consisting of peroxide of iron and decomposed potash felspathic minerals, I never saw 20 tons of Swedes obtained by a less application than 20 tons of manure; and it must be pretty good land, and a tolerably good, *i. e.* moist, season to do so.

The bones should be dissolved in the acid, previously diluted with an equal measure of water. When they become thoroughly broken down, the sulphate of magnesia and the carbonate of potash should be added, and the whole well stirred and left at rest for twenty-four hours. At the end of this time the mixture will, in all probability, be found sufficiently dry, when broken up, to be distributed by the hand. It might otherwise be mixed with ashes or mould, in order to attain the proper condition.

If we reduce the value of farm-yard manure to its respective equivalents, it will be found that the price usually accorded to that article closely approximates the commercial cost of obtaining the same articles from the chemist: for instance, farm-yard manure contains, on the average, about 0·5 per cent of ammonia, and 0·35 per cent each of phosphoric acid and potash. Taking these data, it will follow that 10 tons of farm-yard manure, or

22,400 lbs., containing	0·5	per cent	ammonia, = 112 lbs., worth .	£2	0	0
22,400 ...	0·35	...	phosphoric acid, = 78·40 lbs., or the equivalent of 2 cwt. of super-phosphate of lime, worth . .	0	14	0
22,400 ...	0·35	...	potash, = 78·40 lbs., or the equivalent of 1½ cwt. sulphate of potash, worth 18s. per cwt.* . .	1	7	0
			Gypsum, magnesia, salt, &c., worth about	0	9	0
				£4	10	0

Or 9s. per ton, which is more than the value usually set on farm-yard manure. We will now see whether a special manure cannot be manufactured equal to the above. In the first place it may be observed that 112 lbs. of ammonia may with safety be supplied with 112 lbs. of sulphate of ammonia, which only contain 34 lbs. of real ammonia, in which case the account will stand as follows:—

112 lbs. of sulphate of ammonia, will cost . .	£0	16	0
224 lbs. of super-phosphate of lime	0	14	0
168 lbs. of sulphate of potash	1	7	0
56 lbs. of salt	0	0	6
56 lbs. of Epsom salts	0	4	6
616 lbs.	£3	2	0

or 5½ cwt. of special manure, costing £3, 2s., will be equivalent to 10 tons of farm-yard manure. In the economical application of the special manure a further reduction may be made, as 1½ cwt. of the super-phosphate will be sufficient for 20 tons of turnips, which would reduce the weight to 5 cwt., and the cost to £2, 18s. 6d., or 11s. 9d. per cwt.

* The Rev. Mr Huxtable stated at the Northampton meeting of the Royal English Agricultural Society, that sulphate of potash could be procured at 12s. 6d. per cwt. Such is, however, an impure description, sometimes only containing 30 per cent of sulphate of potash: the wholesale price of sulphate of potash, taking it by hundreds of tons, is at present 15s. to 16s. per cwt.

The question now arises—Can the farmer prepare the above compounds, or purchase the same ready-made more economically? My answer is emphatically, that the farmer cannot manufacture these compounds economically; and I am certain that if sufficient encouragement is given to an honest chemist, such a compound can be manufactured for 10s. 6d. per cwt., leaving the chemist a moderate profit—as it must be borne in mind that the above prices are those as when purchased in retail, which the farmer will always have to do, and generally at a cost exceeding these; besides, he cannot grind the materials into so fine a powder as the manufacturing chemist can do on the large scale; and another consequence will be, that a perfect intermixture of the materials (which is a most important object) will not be accomplished, independent of the annoyance likely to take place by getting farm-labourers to handle carboys of vitriol, &c. On every account, therefore, it is expedient that the improving agriculturists should immediately set about patronising one or more honest and talented agricultural chemists, who will devote their attention to supplying the wants of the farmer. By this means only will the whole benefit derivable from the use of special manures be ever accomplished. Nothing can be more unscientific than the present mode of manufacturing special manures. Superphosphate of lime supplies only the phosphate of lime and gypsum, with a small portion of ammonia. Guano supplies ammonia and phosphate of lime. The compounds of ammonia, such as the sulphate and muriate, only furnish azotised matter; yet each of these are advertised as specifics, and certificates are appended to the prospectuses of each vendor, showing their remarkable success, and doubtless correctly so; but it must be remembered that success in succeeding years will be rendered exceedingly doubtful, unless the special manure contains *all the mineral ingredients required by a crop*, together with some nitrogenised substance, such as a salt of ammonia.

Seeing that super-phosphate of lime, ammonia, guano, &c., applied alone, have produced, in several instances, most surprising effects, it may be presumed that a less quantity of the expensive articles, potash and ammonia, may be applied than the amounts which are theoretically pointed out. In such cases the deficiency of ammonia will be supplied from the atmosphere, and the deficiency of potash by the soil. The source of supply for ammonia will be the same for all soils; but, as respects potash, there will be a remarkable difference—clays and friable loams, formed by the decomposition of potash-felspars, &c., being capable of supplying potash to crops for a considerable number of years, whilst siliceous (sandy) soils will speedily become exhausted. Turfy and chalky, or other calcareous soils, will require a constant supply of potash. Taking all the preceding matters into consideration, it appears to me that a special manure might be manufactured, composed of the following materials,

at a cost of 10s. 6d. per cwt., which would suit, on the average of soils, such crops as carrots, turnips, mangold wurtzel, &c., calculating the crop at 20 tons per acre, viz.:—

cwt.	qrs.	lbs.				
0	2	0	Sulphate of ammonia	£0	8	0
1	2	0	Super-phosphate of lime as manufactured . .	0	10	6
0	2	0	Sulphate of potash	0	9	0
0	2	0	Salt, magnesia, &c., including cost of package, grinding, &c.	0	4	0
3	0	0		£1	11	6

The above would also supply the wants of all descriptions of grain crops, a little silicate of soda being added.* For potatoes 4 cwt. of sulphate of potash, and a ½ cwt. to 1 cwt. of sulphate of ammonia should be added.

The question which now arises is, *Are the preceding observations borne out by actual experiments?* The answer is *Yes*. In reviewing the various experiments detailed respecting the use of special manures, it will be observed that wherever ammoniacal matters, phosphate of lime and potash salts, are combined, the crop in such case has been the most luxuriant.

In Mr Gardner's experiments, detailed at page 20 of the *Highland Society's Transactions* for July 1847, Table A, Hay,—

No. 1. Nothing applied, produced . . .	41 cwt. 54 lbs. hay.
Whilst No. 17, composed of animal charcoal, dissolved in sulphuric acid, horn dust, carbonate of magnesia, sulphate of soda, common salt, sulphate of ammonia, potash, carbonate of soda, produced . . .	116 cwt. 46 lbs. ...

Table C, page 22:—

No. 1. Nothing, (six years lea,) produced . .	22 cwt. 60 lbs. ...
5. Nitrate of potash, horn dust, common salt, gypsum, kelp, sulphate of magnesia, produced	76 cwt. 32 lbs. ...
13. Nitrate of potash, 2 cwt., . . .	57 cwt. 0 lbs. ...

In the experiments made by Mr Alexander Main, in the *Highland Society's Transactions* for January 1848, he states,—"I now proceed to review the specifics in this experiment; and first in order of merit is saltpetre refuse. This is an excellent specific, and one of those, circumstances of soil or season apart, which invariably point in the right direction. In value, saltpetre refuse takes the first place in the *individual* applications. In productive value, in respect of grain, it is superior to all the *individual* applications; is surpassed, however, by No. 9 of the mixtures, and equalled by No. 14. In

* Silicate of soda might, for the cereals, replace a portion of the super-phosphate and potash in the above recipe.

straw, it surpasses all the *individual* applications, but is beaten by mixtures Nos. 9 and 14." In another place, Mr Main states that "saltpetre refuse corroborates this year the favourable opinion I had previously formed of it. This manure affords a good *colour* appearance, but is one of those whose *face* is not fallacious. I consider this a standard specific, and one whose merits may be fully relied on." Now, saltpetre refuse is of most variable quality for agricultural purposes, in some instances consisting merely of common salt and a little saltpetre; some saltpetre brought from the East Indies contains an important amount of nitrate of soda, others contain muriate of potash; all the saltpetre refuse will contain a small quantity of saltpetre, (nitrate of potash.) In applying saltpetre refuse, it follows that a most variable manure is used, sometimes almost wholly consisting of common salt, in others a very large per-centage of muriate of potash. It is to the potash present that we may attribute its fertilising effects; the variety in its composition will account for its variable success, whether used alone or in company with other manures.

The following experiment, reported in the *Journal of the Royal Agricultural Society of England*, is particularly important in reference to this subject. The experiment was made by Mr Thomas Page, who describes the soil to be "a light blowing sand, very shallow, with a considerable quantity of rubbly surface stones, resting on a subsoil of sandstone rock. In point of quality, I believe I am justified in saying it is almost as poor as any land in the county of Surrey."* "From the backwardness of the season, and the multiplicity of work which necessarily attends an extensive breadth of turnips, the sowing was delayed till the 22d and 23d of July." "The seed was drilled, and of the kind *red round.*"

"The field was divided into ten portions, containing an acre; but owing to some part of the manure not being sufficiently dry to work properly, the divisions first made were altered, and only nine portions are therefore alluded to. The field was of uniform quality, and the cultivation, both previous and subsequent to sowing, on all parts exactly alike." Here were the conditions requisite to make a fair experiment—viz., a soil almost destitute of the more valuable ingredients required for fertility, viz., ammonia or nitrogenous matters, phosphoric acid and potash: the results show, that when those substances are combined in a state adapted for immediate assimilation, the fertility is made most apparent. The small excess of No. 2 over No. 1 may be accounted for by the bones not being sufficiently pulverised; thus showing the importance of having all the materials composing the food of plants in as available a condition as possible.

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* Surrey is noted for containing large tracts of very poor soil.

TABLE OF THE QUANTITY AND DESCRIPTION OF DRESSINGS APPLIED FOR THE GROWTH OF TURNI
ON THE TEN ACRE PIECE OF LAND AT MERRIDEN, WITH THE COST OF EACH KIND,
AND THE WEIGHT OF THE PRODUCE PER ACRE.

No. of the piece of land.	Quantity of land contained.	Descriptions of the dressings applied.	Quantity of each kind used, with their respective costs.	Cost per statute acre.	Weight of roots per statute acre.	Weight of tops and tails per acre.	Total w of pro per st acr
	A. R. P.		£ s. d.	£ s. d.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts.
1	1 0 0	Crushed bones Turf ashes	8 bush. bones, 2s. 6d. 1 0 0 16 ,, ashes, at 5d. 0 6 8 1 6 8	1 6 8	9 1 3 20	3 0 2 16	12 2
2	1 0 0	Crushed bones Turf ashes Nitrate soda Nitrate potash	8 bush. bones 2s. 6d. 1 0 0 16 ,, ashes ... 0 6 8 ½ cwt. soda, at 23s. 0 11 6 ½ cwt. potash 33s. ... 0 16 6 2 14 8	2 14 8	10 1 1 20	3 0 1 4	13 1
3	1 0 30	Crushed bones dissolved in sulph. acid Turf ashes African guano	4 bush. bones ... 0 10 0 84 lbs. acid, at 1d... 0 7 0 16 bush. ashes ... 0 6 8 1 cwt. guano 8*l*. 10s. 0 8 6 1 12 2	1 7 1	12 0 2 24	3 1 2 24	15 2
4	1 0 30	Crushed bones dissolved in sulph. acid Turf ashes African guano Nitrate of soda Nitrate of potash	4 bush. bones ... 0 10 0 84 lbs. acid, at 1d... 7 0 0 16 bush. ashes ... 0 6 8 1 cwt. guano ... 0 8 6 ½ cwt. soda ... 0 11 6 ½ cwt. potash ... 0 16 6 3 0 2	2 10 8	14 1 1 4	5 6 1 4	19 1
5	1 0 0	Muck of an ordinary kind African guano Turf ashes	8 cart loads of muck, at 4s. ... 1 12 0 3 cwt. guano ... 1 5 6 20 bush. ashes ... 0 8 4 3 5 10	3 5 10	13 1 2 24	5 0 0 0	18 1
6	1 0 0	Muck African guano Turf ashes Nitrate of soda Nitrate of Potash	8 loads muck ... 1 12 0 3 cwt. guano ... 1 5 6 20 bush. ashes ... 0 8 4 ½ cwt. soda ... 0 11 6 ½ cwt. potash ... 0 16 6 4 13 10	4 13 10	13 1 0 10	4 0 0 16	17 1
7	1 0 30	Muck Crushed bones dissolved in sulph. acid Turf ashes	8 loads muck ... 1 12 0 4 bush. bones ... 0 10 0 84 lbs. acid ... 0 7 0 16 bush. ashes ... 0 6 8 2 15 8	2 6 0	7 1 2 26	3 0 1 20	10 2
8	1 0 30	Muck Crushed bones dissolved in sulph. acid Nitrate of soda Nitrate potash Turf ashes	8 loads muck ... 1 12 0 4 bush. bones ... 0 10 0 84 lbs. acid ... 0 7 0 ½ cwt. soda ... 0 11 6 ½ cwt. potash ... 0 16 6 3 17 6	3 4 10	12 0 0 0	3 1 1 4	15 1
9	1 1 0	Muck Crushed bones dissolved in sulph. acid African guano Turf ashes	8 loads muck ... 1 12 0 4 bush. bones ... 0 10 0 84 lbs acid ... 0 7 0 1½ cwt. guano ... 0 12 9 16 bush. ashes ... 6 8 3 7 5	2 14 8	12 1 2 20	3 1 3 8	15 [illegible]

* By measure, 820 bushels per acre, weighing 40 lbs. per bushel.

The following are Mr Page's remarks on the growth of the turnips:—"On all the portions where dissolved bones were used, the plant came more forward to the hoe than where they were not used; but beyond this there was not much perceptible difference in the appearance of the different parts, until from a month to six weeks had elapsed, when No. 7 began to grow less rapidly than the rest. At the end of between seven and eight weeks, No. 1 began to fall off, and in a few days No. 2 followed." "Further than this difference, the eye could hardly detect where the separation of each kind of dressing took place."

After these examples, I leave the reader to form his own opinion.

A very important point connected with the application of all manures, is the period at which the dressing should be laid on; the manner of doing so is scarcely of less consequence. I will consider the two points in combination, to root crops such as turnips, carrots, potatoes, &c. Special manures are best applied by drill in combination with the seed sowing; for winter grain spring top-dressing, I think, ought to be preferred, the manure being sown broad-cast; by so doing, the great waste caused by the solution of the manure during the winter rains will be obviated, and the whole will be available during that period when vegetation is most vigorous.

I shall conclude this paper by a few cautionary remarks respecting the adulteration of manures. It was well remarked in "The Plough," so long ago as 1844, "that in many cases much money has been wasted in the purchase of substances, certainly confidently recommended, and high-priced enough, while we have as useful and even more beneficial materials neglected and going to waste at our own doors." "The manure manufacturers are following the example of the universal medicine-venders, and are patching up the reputation of their articles by certificates, &c., fully as worthy of credit. The literary efforts of Morrison's and Parr's pills establishments are equalled, if not surpassed, by the proprietors of artificial guano, dry and soluble fertilisers, &c.; and the recommendatory puffs of each have about equal claims on our credence." As an instance of which, the following is given, on the authority of Mr Guy of Painswick, of an attempt to impose on him:—

"The object of the party in sending me the guano so shamefully adulterated, was to ascertain if I would become an agent for its sale; if so, I was to receive a handsome remuneration, &c. My answer was to be left at a Post-office; and every precaution was taken to prevent the locality being detected, in case the proposition did not meet with a favourable reception. The so-called guano consisted of a portion of red marl and old mortar crushed together, to the extent of 95 per cent; the remaining 5 per cent consisted of vegetable matter (probably partially decomposed saw-dust) and genuine guano. This mixture had been moistened with putrid urine and redried. It certainly had the appearance of a fair sample of guano when casually looked at, and would, no doubt, deceive any

person unaccustomed to the genuine article." Saw-dust is a common source of adulteration, being ground and mixed with a little free ammonia, formed by mixing a little sulphate of ammonia and quicklime. I have seen guano imitated by using the refuse of the soda-ash manufactures, consisting, when it has remained in a heap for a long period, of sulphate and carbonate of lime *flavoured* with ammonia in the same way, in which no one could perceive the difference between this stuff and genuine guano. I have seen the same with ground saw-dust. Another fraud is committed in the salts of ammonia. I had a sample procured for me at Leeds, which was sent to that town from London as genuine sulphate of ammonia, and sold at £9 per ton, the agent at Leeds having a commission of £1 per ton. It consisted of gypsûm and saw-dust, the saw-dust being previously steeped in the ammoniacal liquors of the gas works. Its value was about 30s. per ton. Another extensive source of fraud and adulteration, but certainly the least injurious, is grinding up night-soil (previously dried,) and selling the same for super-phosphate of lime, and then mixed with cheaper matters for bulk.

THE FARMERS' NOTE-BOOK.—No. XX.

On Useful Insects and their Products.—By JAMES H. FENNELL, Author of "A Natural History of Quadrupeds," &c.—(*Continued from* p. 334.*)—From the earliest ages the culture of bees has been regarded as a matter of great importance, their honey and wax being articles of extensive consumption, adding considerably to the commercial traffic of various nations. The Greeks were large cultivators of bees, whose habits they studied with much enthusiasm. Aristamachus, of Soli, wrote upon them after fifty years' experience; and Philiscus employed his whole life in forests and deserts attending to their history. Solon enacted a law, that every man's stock should not be nearer than three hundred feet to his neighbour's.

As the first cost of a stock or two is very trifling, and as the management of them requires no labour nor much skill, not only farmers, but all small cottagers who have a garden, ought to keep bees, and make a profit of them. What is there to prevent every small holder in Ireland and Scotland from supplying some of that honey and bees'-wax for which, at present, England pays so many thousands of pounds to American, Dutch, French, and Italian importers? True, the culture of bees is a considerable article of rural economy along the banks of the Tay, Clyde, and Teith. It is related that a good old French bishop, in paying his annual visit to his clergy, arrived at the house of a curate, who, living amongst a

* The following errata are observable in the last article—viz., at p. 328, for *crevice*, read "crevise;" and at p. 329, for *waggon-locusts*, read "waggon-loads of locusts."

shockingly poor set of parishioners, he fully expected to find in a more woeful plight than others of his reverend calling. To his amazement, however, he found that the curate had a cheerful face, a plentiful board, and a comfortable house. "Have you," inquired the bishop, "any income independent of your parishioners?" "Yes, sir," replied the curate, "I have; my family would starve on the pittance I receive from the poor people I instruct. Come into my garden, and I will show you the bank from which I draw an excellent interest, my annual dividend. It never stops payment." The bishop saw there a large range of bee-hives; and ever after that, when any of his clergy complained to him of poverty, he would say to them, "Keep bees—keep bees!"

Throughout nearly the whole of Europe the hive-bee engages much attention. In Russia, the culture of bees is a matter of greater importance than in most other parts of Europe, being there a source of existence to many entire communities. Independent of their own consumption of bees'-wax, the Russians annually export from twelve thousand to fifteen thousand pounds' weight to foreign countries, from the ports of the Baltic alone; and European Russia supplies nearly the whole of Siberia with honey. Amongst the Bashkirs, it is not unusual for an individual to possess a hundred hives of bees within the limits of his own garden, and as many as a thousand hives, or hollowed trees, of wild bees in the adjacent forests, yearly deriving from them forty, and sometimes even one hundred, pounds' weight of honey. Although hives are to be found in almost all portions of the Russian empire, their numbers are infinitely exceeded by those of the wild bees in the hollow trees of Orenburg, more particularly in the extensive forests of the Oural. Beyond the Oural mountains, and throughout Siberia, no wild bees are to be met with. It is difficult to learn how far northward in Europe hive-bees are found. That they are unknown in Lapland one may infer from Scheffer's statement, that the Laplanders eat the bark of the pine-tree, prepared in a certain way, instead of sugar; for if they had honey, there can be little doubt they would prefer it as a much better substitute for sugar.

From Europe the hive-bee has been exported to many parts of the world where it previously did not exist. It has been asserted that the hive-bee in the tropics ceases to collect honey, and that wasps, which in our country are subterranean builders, build there in trees. If any country has bees that collect no honey, and wasps that never build underground, we may rely upon it that they are not the same species as our hive-bees and common wasps. In Great Britain, hive-bees are not found in a wild state; for though it is not uncommon for swarms to stray from their proprietors, these stray swarms do not spread colonies through our woods, as they are said to do in America, where numbers of bees' nests are found in the hollow trees. These American forest wild bees, whose

sweets are much sought after by the bears, will explain the following occurrence:—In cutting up at the Greenock Patent Saw-Mills, in July 1839, a log of St John's yellow pine timber, of about one hundred and forty years' growth, as indicated by the annular fibres of the wood, it was found to enclose a hive of bees in all stages of transformation, from larvæ up to mature bees, all in perfect preservation, but presenting an appearance like that of our own honey-bees after having been killed by smoke. The bees seemed to have taken up their abode in the tree when it was only about thirty or forty years' old, consequently had been about a hundred years in the tree at the time it was felled. We may therefore suppose the bees to have taken up their abode in the tree about the year 1740. Though Marcgrave mentions a species of honey-bee in Brazil, yet from his description it appears to have no sting, and is, therefore, different from the one found in the United States, which seems to resemble perfectly the European species. In the province of Guadalaxara, in Old Mexico, there is a species of bee without a sting, and hence called *angelitos*,—little angels. In the year 1832, Henry Perrine, consul for the United States at Campeachy, sent to New York a hive of stingless bees from Yucatan, in Mexico, to ascertain if these useful insects could be acclimated.

The native tribes of America say that hive-bees were originally introduced among them from Europe, but when and by whom none of them could tell. The only name they have for them is the "white man's fly," and they regard their wider diffusion as indicating the encroaching progress of the white settlers. It is said that the first planters in New England never saw any bees there; that the English introduced them to Boston in 1670; and that since then they have spread over the whole continent. Washington Irving has written an account of the progress which the hive-bee is making westwards in America; and about sixty years ago, when Bartram inquired how it was that westwards, among the Creek Indians, he had seen no bees, he was told by a Dr Grant that there were few or none west of the Isthmus of Florida, and but one hive in Mobile, which had been lately brought from Europe, the English supposing that there were none in the country, not finding any when they took possession after the Spanish and French. Bartram was also assured by the traders that there were no bees in West Florida, which he thought extraordinary and almost incredible, since they were so numerous all along the eastern coast, from Nova Scotia to East Florida, even in the wild forest, as to be thought by the generality of the inhabitants aborigines of that continent. At the present time the honey-bee is abundant throughout the United States, both as a denizen of the forest and a dependant on man.*

* Bartram's *Travels through Carolina and Florida* (1791.)

Generally speaking, the settler in the backwoods prefers the precarious but luscious supply afforded by those swarms which have deserted man, and taken up their abode in fissures of rocks or hollows of trees, to the more regular, but less abundant, supply from hives of his own. Kalm asserted that the honey-bee could not live throughout the winter in Canada; but MacTaggart assures us that bees thrive very well there, the hives, in winter, being housed-in to protect them from the inclemency of the weather. The honey, which is very cheap in all the old settlements, is not of the best quality, owing to ordinary flowering plants not being so plentiful as trees. Colonel Talbot states that many of the farmers have from twenty to thirty hives; independently of which, trees are discovered in the forests from whose hollow trunks from seventy to a hundred and fifty pounds weight of honey are frequently taken. The Canadians adopt an ingenious plan for discovering the trees that are stored with honey. They collect a number of bees off the flowers in the forest, and confine them in a small box, at the bottom of which is a piece of honeycomb, and on the lid a square of glass large enough to admit the light into every part. When the bees seem satiated with honey, two or three are allowed to escape, and the direction in which they fly is attentively observed until they become lost in the distance. The bee-hunter then proceeds towards the spot where they disappeared, and liberating one or two more of the little captives, he also marks their course. This process is repeated, until the other bees, instead of following the same direction as their predecessors, take the direct opposite course, by which the hunter is convinced that he has overshot the object of his pursuit; for it is a well-known fact, that if you take a bee from a flower situated at any given distance *south* of the tree to which the bee belongs, and carry it in the closest confinement to an equal distance on the *north* side of the tree, he will, when liberated, fly in a circle for a moment, and then make his course direct to his sweet home, without deviating in the least to the right hand or the left. The hunter is now very soon able to detect the tree which contains the honey, by placing on a heated brick a piece of honey-comb, the odour of which, when melting, is so strong and alluring, as to entice the whole colony to come down from their citadel. When the tree is cut down, the quantity of honey found in its excavated trunk seldom fails to compensate the hunter very amply for his perseverance. The author of *A Tour on the Prairies* says the Indians regard the bee as the harbinger of the white man, as the buffalo is of the red man; and say that, in proportion as the bee advances, the Indian and the buffalo retire. The wild bee is said to be seldom met with at any great distance from the frontier. When the honey-bee first crossed the Mississippi, the Indians, with surprise, found the hollow trees of their forests suddenly teeming with honey; and nothing can exceed the greedy relish with which

they banquet for the first time upon this unbought luxury of the wilderness. At present, the honey-bee swarms in myriads in the noble groves and forests that skirt and intersect the prairies, and extend along the alluvial bottoms of the rivers. These beautiful regions seem literally to answer to the description of the land of promise, "a land flowing with milk and honey;" for the rich pasturage of the prairies is calculated to sustain countless herds of cattle, while the flowers with which they are enamelled render them a very paradise for the nectar-seeking bee.* In New Zealand the honey-bee was not known till 1840, when Mrs Allom transmitted the first bees ever seen there. To effect her object, she procured a large oblong wooden box, having its top, and also its front, of perforated zinc, containing in the centre a common straw-hive, which had an entrance in front; on either side was a wooden breeding-box communicating with the pavilion; on the top of the case was a circular zinc feeding trough, furnished with a cylindrical passage from the interior of the case, through which the bees passed to a perforated zinc floating stage above the hive, on which they rested while feeding; the feeding-trough was filled with liquid honey, through a funnel-shaped opening on the side, a glass top permitting the bees to be seen while feeding. During the voyage they were fed twice a-week with two-thirds of honey, and one-third of water. They arrived safely, and, according to the statement of Mr William Brown, in his work on *New Zealand and its Aborigines*, (1845,) they have already thriven so well that an export trade in honey is expected shortly. From a number of the *Sydney Gazette* we learn that Mr D. Wentworth placed on his estate at Homebush, near Parramatta, two hives of bees procured from Captain Wallace of the Isabella, and which produced three swarms of young bees during the three first weeks of October 1823. The fragrant shrubs and flowers of Australasia being thought quite congenial to the bees, we trust that, in a few years, honey and wax will hold a prominent place in the numerous productions of the colony.

A hive contains three different classes of bees—namely, the queen, or female; the drones, or males; and the workers, or imperfectly developed females; these three classes varying in number and size. The average number of bees in a hive or swarm is variously stated by different authors. Stawell, in his *Notes on Virgil*, gives the general number at about 16,000; an anonymous author says from 15,000 to 20,000; the *Edinburgh Journal* (No. 219) states from 20,000 to 25,000, and assures us that before swarming there may be upwards of 40,000 in a populous hive; while a reviewer of Bevan's work on bees says it is 52,000. One says that there are

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* A question has been raised as to the specific identity of the European hive-bee, and those of certain parts of America; and a long memoir upon the subject is published in one of the early volumes of the *American Transactions*.

15,000 workers; another says 19,499; a third says 20,000; and a fourth says 50,000: the number of drones, we are told by one writer to be 500; by another, from 600 to 2000: and by a writer in the *Entomological Magazine* at usually 2000.

The hives in Persia are constructed like long thin barrels thrust through the mud walls of the house; one end opening to the air for the entrance of the bees, and the other, which projects more than a foot into the inhabited rooms, is closed with a cake of clay. Sir Robert Porter states that, when the owner wishes to take the honey, he merely makes a continued noise for some little time at the closed end, which causes all the bees to take flight at the other. During their absence he removes the clay, and clears the hive of honey, leaving, however, sufficient for their winter supply. The inner end is re-closed, and the little labourers soon return to their home to commence their operations anew.

In Cashmere every farmer has several bee-hives, sometimes as many as ten, in his house, formed merely by leaving appropriate cavities in the walls, somewhat differing in size, but agreeing in their general form, each being cylindrical, and extending quite through the wall. The tube thus formed is lined by a plastering of clay mortar, about an inch in thickness, and the mortar is worked up with the chaff or husk of rice, or with the down of thistles, which latter is employed also for clay mortar in general. The dimensions of a hive are, on an average, about 14 inches in diameter, and, when closed at both ends, about 20 or 22 inches in length. That end of the cylinder nearest the apartment is closed by a round platter of red pottery ware, a little convex in the middle, but with the edges made flush with the wall by a luting of clay mortar; and the other extremity is shut by a similar dish, having a circular hole about a third of an inch in diameter in its centre. These hives are sometimes confined to the walls of the lower or basement story, generally appropriated to cattle in the farm-houses of Cashmere; at others are inserted into those of the first floor, and are frequently seen in both situations in the same house, as well as in the walls of its out-buildings. The bees are a little smaller than those of Europe, though a little larger than the domesticated bee of Kumaoon and of Gurwhal. Little difference exists betwixt the practices ordinarily pursued in Cashmere and in Europe, in respect to hiving new swarms; but that adopted for preserving the old swarm, when the honey is taken, well deserves imitation by other bee-farmers. The taking of the honey is effected with little injury to the bees, and with perfect safety to the individuals concerned in its management. Having, with a few strokes of the point of a sickle, removed the inner platter of the tube, thus bringing into view the combs suspended from the roof of the hive and covered with bees,—none of which, however, offer to resent the aggression, or to enter the room,—the farmer holds close to the mouth of the hive an earthen dish con-

taining a small quantity of burning charcoal, upon which is placed a wisp of dry rice-straw, and blows the smoke strongly against the combs, but removes the straw whenever it catches fire, to prevent its burning the bees, and extinguishes the flames before he employs it again. Almost stifled by the smoke, the bees hurry through the outer door so rapidly, that in a few minutes they are all out of the hive; when the farmer, introducing his sickle, cuts down the nearest combs, which are received in a dish previously slidden underneath them, and leaves undisturbed about one-third of the combs which are almost close to the outer door, and he then replaces the inner platter. Those few bees that are seen, in a state of stupefaction, clinging to the combs, or lying motionless on the floor of the hive, eventually recover. The expelled bees return as soon as the cavity is freed from smoke, without stinging a single individual; and the whole business is completed within ten minutes, without any perceptible loss. It is customary to take the honey every year, and the best season for this operation is found to be the end of September or beginning of October; a little time still remaining to the bees to add to the portion left for their support during five months. This consists of about one-third of the whole produce; and it seems to suffice, as swarms seldom die, and the Cashmerees substitute no other article of food. It is stated that an old swarm yields more honey than a young one, and that swarms rarely die except of old age; the situation of the hives keeping off many natural enemies. Moorcroft was informed that it is no uncommon circumstance to preserve the same community for ten, and even fifteen years, and some instances were quoted of a swarm having been retained for twenty years; but this was held to be of very rare occurrence. In consequence of the bees being thus literally domesticated, they seem to acquire a mildness of conduct far more decided than those of Europe; and it is possible that the confidence thus gained, subduing their natural irascibility, generates an increase of industry, or, at least, an increase of produce in relation to the number and size of the individuals of each community. The Cashmere honey is light-coloured, and of a taste as pure and sweet as that of Narbonne, possessing less of the cloying quality which generally characterises this production. The peasantry are unacquainted with the employment of honey as the basis of a fermented liquor, but eat it raw, or mixed with articles of common food, whilst the more wealthy substitute it for sugar in preserving fruits.

Bell, in his *Residence in Circassia*, describes a Circassian bee-yard—a large oval space securely hurdled around, and containing sixty-seven hives of wicker-work, covered with clay, hardened in the sun. He was told that the Circassians take the honey without destroying the bees.

The Choura, or the wild rock-bee of Gurwhal, (*Apis irritabilis*,)

is very much larger than our common domestic bee of Europe, and greatly exceeds it also in the number of individuals in each community, and in the size and weight of its combs. But in the northern mountains, its honey is sometimes contaminated by an intoxicating or poisonous quality, supposed to be caused by its resorting to the flowers of the monkshood, or aconite; and the insect itself, upon the slightest occasion, displays great irritability, which unamiable disposition is probably induced by the circumstance of the exposed situation of the combs, suspended from the lower surface of a ledge of rock, rendering them subject to occasional annoyance from bears, and other unwelcome partakers of their honey. These detractions, however, are merely the result of locality; and, under due precautions, its irascibility might be so far subdued as to render it just as safe an inhabitant of a wall hive as the smaller variety of bee. This large bee is also met with in a portion of the Punjaub, near the hills; and Moorcroft saw the under surface of the principal branches of a large peepul tree studded with so many colonies, each of such great strength as to deter the neighbouring peasantry from attempting to deprive them of their stores, although it was conjectured that there were several hundredweights of combs on the tree. The largest of these assemblages of combs, probably the accumulation of several seasons, was of an enormous size; and from the specimens of the honey seen by Moorcroft, he conceives that the introduction of this species of bee into Europe, and its domestication here, would prove a most valuable acquisition.

He who wishes his bees to thrive well, must not omit to select the site for his hives with care. The best situation is one that is pretty open to the south and south-west, but by all means well sheltered on the north, north-east, and south-west, to protect the hives from those heavy gales which prove often so disastrous to bees. In winter, however, at which season it is advisable to protect the hives from both severe weather and sudden heat, their aspect should be either north, north-east, or north-west; because a warm sun shining on the hives often induces the bees to roam prematurely abroad in search of flowers before they are to be found in sufficient numbers to yield them sustenance,—the result being that the bees are exhausted by their long flight in pursuit of food during the heat of the day, and are unable to reach home before the frost sets in. At any season, the hives should not be placed too near a high wall, for the bees, in that case, are apt to be dashed against it in high winds, when they fall to the ground, and, being laden, and fatigued by a long flight, are not able to recover their wings, and may often be observed, in this forlorn condition, sitting on the ground quite distressed. The best shelter from a biting north wind is a close beech hedge, neatly clipt, or a few low-growing and thickly-planted shrubs. No tree or house should overshadow

or drip on the hive. Nothing should be placed too near it in front, except, perhaps, a few low-growing flowers; and immediately round it the earth should be dug away, and a coat of clean sea-gravel laid, and always kept free from weeds, that no harbour may be afforded to snails and moths, which sometimes intrude into the hive, annoy the bees, and make free with their honey. The hive should stand at least one foot and a-half from the ground, with the entrance turned rather towards the south-east, in order that it may have as much of the forenoon sun as possible; and when there are several hives in an apiary, the distance between them should not be less than four feet; if room permit, even twice that distance would be better. It is well when the hive happens to face a sitting-room window, so that the bee-master has a better chance of attending to any thing amiss in it.

The best place to keep hives in during the winter is a dry, cold, and dark room, or outhouse. At this season a hive should have but very small entrances, just sufficient to admit the ingress or egress of two bees at a time, for it is important to endeavour to retain the natural warmth of the hive. For this purpose small pieces of wood should be so fixed in the entrance that, as the season advances, it can be enlarged as required. The great object in winter is to keep them in a dry place, for, if they are in a damp situation, they will die of the rot; and it is also advisable to exclude the sun from them, for a bright day in December might tempt many to go out, who would fall to the ground immediately if caught by a cold wind. It is recorded in the *Horticultural Register*, January 1834, that, during the fall of the previous year, Mr Etheridge of Montrose, an extensive bee-keeper, buried several of his hives in the ground, at a sufficient depth to be beyond the reach of the frost, and protected from the cold air penetrating to them, being first covered with straw to about the thickness of ten inches before being covered with mould. When taken up, in April, the bees were found to be in good health. They had not eaten any of the honey, for there appeared to be as much in the hives as at the time they were buried.

To make the harvest of their bees as abundant as possible, the ancients used to change the stations of their hives. When the vernal pastures were exhausted, they were moved to climes more favourable to the bloom of autumnal flowers. From Achaia to Attica, from Eubœa and the Cyclades to Scyros; and in Sicily they were brought to Hybla from other parts of the island. This ancient custom is still preserved in Egypt, for at the end of October the hives are embarked on the Nile and conveyed to Upper Egypt, where all plants blossom and fruits ripen six weeks earlier than in the Delta.* As Upper Egypt only retains its verdure for four or

* See Maillet's *Description of Egypt.*

five months, and the flowers and harvests are earlier there, this circumstance induces the inhabitants of Lower Egypt to collect the bees of different villages in large boats, wherein each proprietor trusts his hives, which have a particular mark; and when the boat is loaded, it is gradually moved up the river, stopping only at such places as afford flowers and verdure. At the break of day thousands of bees quit their cells and go in quest of honey, going to and fro several times laden with booty; in the evening they return to their habitations, without ever mistaking their dwellings. After travelling three months in this manner on the Nile, the bees, having culled the perfumes of the orange-flowers of Saïd, the roses of Fayoum, the jasmines of Arabia, and a variety of other flowers, are brought back to the places they had been carried from, where they now find new riches to partake of. This industry procures the Egyptians delicious honey and good bees' wax in abundance. Floating rafts of bee-hives may also be seen in France and Piedmont, moving from place to place to afford fresh supplies to the industrious insects:—

> Lo, through the vales of Loire the bee-hives glide,
> The light raft dropping with the silent tide;
> Lo, till the laughing scenes are lost in night,
> The busy people wing their various flight,
> Culling unnumber'd sweets from nameless flowers
> That scent the vineyard in its purple hours.
>
> ROGERS.

In the spring and summer, hives should be placed near meadows and lime-trees—

> —— the sweet limes, so full of bees in June;

but in autumn near furze and heather. The flowers of the white lime-tree yield the best Russian honey, which is more abundant in the districts where these trees are plentiful, as on the banks of the Oka and the Don, in White and Little Russia, in Poland, and in the southern parts of the Oural, situated in Europe. The apiaries of the Greeks and Romans had odorous shrubs and herbs, suited to bees, expressly planted in their vicinity, and they were situated near a spring or rivulet, which had small holes covered with little transverse sticks, that the bees might more easily and safely drink. Buckwheat, sainfoin, honeysuckle, jasmine, mignionette, viper's-bugloss, beans, thyme, borage, mustard, sage, &c., should be grown near the hives, and would, with the aid of fruit-tree blossoms, furze, broom, heath, and clover, amply supply the bees. M. Martin, in his treatise on the culture of buckwheat and sainfoin, considers these two plants the most favourable of any to the production of honey. Some years ago M. Scheidlin, gardener to the King of Wurtemberg, observed that bees were fond of sucking the saccharine particles of the boiled raspings of carrots, and accordingly placed some, boiled to a jelly, near their hives.

Honey was the substitute for sugar among the Greeks and

Romans, who used it in great quantities: much, however, was adulterated with the heavier weighing wax, and he was an honest man who sold pure honey; hence our adjective *sincere* is from the Latin words *sine cerâ*, without wax—no deceit. Though Ovid regards honey as an incentive to lust, it is said to be extremely conducive to health. An old man, in his hundredth year, being asked by the Emperor Augustus how he contrived to attain so great an age, replied, "By nourishing my inside with honey and my outside with oil." Hŏney is also a great preservative, and therefore the bodies of the Spartan kings who fell at a distance in battle were preserved in honey, in order that they might be conveyed home without corrupting. It was an article of much greater consumption in Britain when its accompaniment, wax, was more extensively required to give light. The Forest Charter of Henry III. permitted every English freeman to take whatever honey he found in his own woods; and till about the year 1680 our kings always maintained a bee-keeper in their household. In France, honey was a considerable article of trade in the reign of Charlemagne. There, and in the northern parts of Europe, especially Denmark and Sweden, there exist a number of minute regulations for the protection of bees. The abundance of honey produced at Malta is the reason why this almost barren rock was called Melita. The finest honey is produced in Sicily and Minorca; also in Narbonne, the neighbourhood of which town abounds with rosemary. The agreeable aromatic flavour of the honey of Greece is attributed to the juices of the flowers being in a more concentrated state, owing to the heat being moderate. The ancients greatly prized the honey from Mount Hymettus, which was then more abundantly stocked with flowers than at present. Owing to the great and reckless destruction of trees and shrubs in the continued wars of Greece, the Hymettus is very bare, and has now no better vegetation than the mountains of Attica, and its honey no longer possesses the superiority. In other neighbourhoods—for example, in many of the Cyclades, especially in Sekino—the honey is finer and more aromatic. Much esteemed, too, was the honey of the Laurion mountains, whereon the *Erica mediterranea* grows in abundance. The greatest quantity of honey is obtained from the monastery of Syrian, to the north-east of the city, and is delivered to the local archbishop. The honey from Pentelicon is also reckoned among the Hymettic. The number of hives on these mountains yielding honey has been averaged, of late years, at 5000. Dr Fiedler reports that the principal herbs from which these bees derive their honey are *Satureia capitala*, *Lentiscus*, *Cistus*, *Salvia*, *Lavendula*, &c. At the declivities, and in some of the dales of the Hymettus, are wild olives, myrtle, laurel, and oleanders. *Pinus maritima* grows on its summit very imperfectly, but near the monastery it is pretty thick. Besides these the Hymettus possesses hyacinths, *Amaryllis lutea*, dark violet crocus, &c.

The honey produced in the island of Corsica is said to be exceedingly unwholesome, which Virgil apparently attributes to the bees resorting to the yew-trees. He seems to think the Corsican yew particularly hurtful, and he desires that none may be near the hive. Wordsworth speaks of the yew as being rather disagreeable than injurious to bees. The oleander (*Nerium oleander*) yields a honey that proves fatal to thousands of flies, but our bees avoid it. Occasionally, perhaps, in particular seasons, when flowers are less numerous than usual, the instinct of the bees appears to fail them, or to be overpowered by their desire to collect a sufficient store of honey for their purposes, and they suffer for their want of self-denial. Sometimes whole swarms have been destroyed by merely alighting upon poisonous trees. This happened to one in the town of West Chester, New York, which settled upon the branches of the poison-ash (*Rhus vernix*.) On the following morning they were all found dead, and swelled to more than double their usual size. Whether the honey extracted from plants of the genera *Kalmia*, *Andromeda*, *Rhododendron*, &c. be hurtful to bees themselves, is not ascertained; but it has often proved poisonous to man. This fact ought to induce the keepers of bees to be careful how they venture to cultivate plants of noxious qualities near their hives. The Greeks and Romans eradicated all bitter-tasting herbs from the vicinity of their apiaries, lest they should impart a bad quality to the honey. According to De Lille, the bee-keepers of Languedoc also pay great attention to this point. Even wild species of honey- bees will resort to noxious plants quite as readily as the domestic species:

> Like to those bees of Trebizonde
> Which, from the sunniest flowers that glad,
> With their pure smiles, the gardens round,
> Draw venom forth which drives men mad.

Xenophon records that, during the celebrated retreat of the ten thousand Greeks from Persia, the soldiers, when they came to a place on the banks of the Euphrates, near Trebizonde, found many bee-hives, the combs of which they sucked; but soon afterwards they became as though intoxicated, and were attacked with a virulent cholera-morbus. The famous botanist Tournefort, when at Trebizonde, having made some researches relative to this occurrence, was led to suspect that it arose from the bees collecting their honey partly from a plant which is very abundant there, and the very blossoms of which exhale a sweet but intoxicating perfume. This plant was most likely either the rose-laurel (*Rhododendron ponticum*) or the yellow azalea (*Azalea pontica*;) for Father Lamberti found both these poisonous plants, together with poisonous honey, in Mingrelia. Colonel Rottiers, in 1816, observed the rose-laurel growing on all the mountains of Trebizonde; and the inhabitants asserted that "the strong honey" which the bees extract from its flowers is a kind of poison, causing stupor in a greater or

less degree, according to the season of the year. M. Dupré, the French consul, assured Colonel Rottiers that he had experienced this effect himself. The honey of Guriel, a district of Imiritia, in Asiatic Russia, has the same intoxicating quality, and is as hard as sugar. An intoxicating and poisonous honey is extracted from the flowers of the monkshood or aconite by the *Choura*, or wild rock-bee of Gurwhal, in Northern Hindostan. In the autumn and winter of 1790, there was an extensive mortality among the people of Philadelphia, who had eaten of honey that had been collected near that city. The American government having instituted a minute inquiry into the cause of the honey proving fatal, it was satisfactorily ascertained that it had been chiefly extracted from the flowers of the *Kalmia latifolia.* In the *American Philosophical Transactions* vol. v., Dr Barton mentions that the dwarf-laurel, great-laurel, broad-leaved moorwort, Pennsylvanian mountain-laurel, wild honeysuckle, and the stramonium or James-town weed, yield a poisonous syrup, and that the honey which the bees make therefrom has been fatal to man. It is generally supposed that bees feast solely upon the sweets of flowers; but in the environs of Orenburg, in Asiatic Russia, they are believed to suck blood, decayed flesh, &c. Rytchkof, being desirous of ascertaining if bees are really consumers of flesh, plucked a dead fowl and placed it within a hive, where it remained untouched by the bees for three or four days; but no sooner did it begin to decay than they eagerly assailed it, leaving nothing but the bones. They have even been known to make their habitation in the skulls and other cavities of dead animals. Speaking of a dead elephant, Montgomery says—

> Bees in the ample hollow of his skull
> Pile their wax citadels, and store their honey;
> Thence sally forth to forage through the fields,
> And swarm in emigrating legions thence.

Rennie, and some other naturalists, regard bees'-wax as a secretion of the insect, in fact, a strictly animal substance; but the majority think it consists of the collected farina of flowers.* From an analysis of several sorts of wax obtained from different sources, but all of which had an affinity more or less to bees'-wax, M. Lewy concludes that bees do not produce wax from any natural process of their own, but merely collect it. Some suppose that the wax consists of the farina of flowers, cemented by a glutinous secretion in the bees. In 1822 England paid sixty thousand pounds for bees'-wax imported from America, and probably three times that sum for the same article from Holland, France, and Italy. The *Boston Transcript*, in 1846, stated that at least ten thousand hundredweight of foreign bees'-wax is imported into England every year.

* The bee is not the only insect which produces wax, as will be seen when I come to speak of the Chinese wax-making insect, *Cicada limbata.*

Globules of Blood. (From the French.)—It may not be generally known that the blood of various animals is formed of minute globules, which vary in the different species, yet are always alike in individuals. In most mammiferous animals these globules are circular: in other animals they are elliptical. The following table will give some idea of their comparative size:—

1. *Animals with Circular Globules.*

Man	$\frac{1}{120}$	millemetre in diameter.*
Ape, rabbit, dog, pig, hedgehog .	$\frac{1}{130}$	do.*
Ass, cat, mouse . . .	$\frac{1}{170}$	do.
Sheep, horse, ox . . .	$\frac{1}{200}$	do.
Chamois, stag . . .	$\frac{1}{248}$	do.
Goat	$\frac{1}{282}$	do.

2. *Animals with Elliptical Globules.*

	Greater diam.	Lesser diam.
Dromedary, alpaca . .	$\frac{1}{123}$.	$\frac{1}{220}$
Sea-eagle, pigeon . .	$\frac{1}{75}$.	$\frac{1}{160}$
Barn-door fowl . .	$\frac{1}{80}$.	$\frac{1}{160}$
Peacock, goose . .	$\frac{1}{88}$.	$\frac{1}{160}$
Titmouse . . .	$\frac{1}{100}$.	$\frac{1}{130}$
Land-tortoise . . .	$\frac{1}{45}$.	$\frac{2}{77}$
Viper	$\frac{1}{60}$.	$\frac{1}{160}$
Adder	$\frac{1}{50}$.	$\frac{1}{200}$
Lizard . . .	$\frac{1}{66}$.	$\frac{1}{140}$
Frog	$\frac{1}{45}$.	$\frac{2}{75}$
Minnow - . .	$\frac{1}{75}$.	$\frac{1}{128}$

One very curious result of this investigation is the fact that the size of the globule bears no proportion to the size of the animal: for instance, that of the horse is only about half the size of that of man.

Salt from Plants.—Amongst the many singular plants which the researches of travellers have brought to our knowledge, there is none that seems more out of the common run than some described in Mitchell's *Tropical Australia.* Amongst many others, he mentions the Salt bush, (*R. parabolica,*) which abounds in the plains in the centre of Australia, many hundred miles from the sea, and yet it contains nearly $\frac{1}{16}$ of its weight of common salt, 2 oz. being obtained from 2 lbs. of fresh leaf.

New Species of Barley.—A sample of naked barley has recently been sent to this country from India, to the Royal Gardens at Kew. The peculiarity of this grain consists in the husk separating from the grain in thrashing, as does that of wheat. It is called Thibet barley, and is much esteemed in the north of India. It is not known in the lowlands of that country, but is much grown by the natives of the highlands, who find it, from its hardiness, a safe and profitable

* A millemetre is 0·039 of an inch.—EDITOR.

crop. The Tartars are so fond of it, that they live almost entirely upon it and tea. Small portions of the sample, it appears, have been sent to the Royal Agricultural Society of England, and it is to be hoped that they will take measures to try it in this country, more especially as Hooker, from the knowledge he has of its native habitat, thinks it would suit the Highlands of Scotland.

*Liebig's Chemistry of Food.**—Though we are always glad to see another work issue from the pen of such men as Liebig, yet there is a painful, or at least an unpleasant feeling connected with the writings of that celebrated man, which has accumulated in our mind as each new edition or new work has appeared. Whilst we admit most cordially that he has done more than any other living chemist for the progress of organic and agricultural chemistry, we cannot shut our eyes to the fact that there is a silent influence at work, which must, in the end, lower Liebig from his present proud position. The fact is, he must have found publishing a good speculation; and, acting under this impression, no sooner has he made a discovery himself, or seen an account of one by another, than a book, with that for the text, is got up and presented to the English public, under the certain conviction that the name of Liebig will insure a rapid and highly remunerative sale. With the two books at the head of this article we are especially disposed to find this fault. They are literally only fit to appear as articles in a magazine, as you there tolerate the acknowledgment of unfinished investigations, though that is intolerable as the "finis" of a book. The *Chemistry of Food*, in the midst of a perfect avalanche of theory, contains little new, and nothing practical, except a method for cooking meat, founded on scientific principles. It is there recommended to introduce the joint into water in a state of quick ebullition, allow it to remain in this state for a few minutes, and then as much cold water is to be added, as to reduce the temperature down to about 160°, in which state it is to be kept for some hours. By the application of boiling water at the first, the albumen is coagulated, so as to prevent the water from penetrating into the interior of the joint and extracting the soluble juices. Besides this, there is so little new in the work, that we would recommend the general reader to content himself with the preface by the editor,† which is not only necessary to enable any one to understand the work, but really contains a masterly summary of the whole. Far be it from us to disparage the researches of such master-minds as Liebig's: our only motive in the previous remarks is to point out what we consider an error in his mode of making them known to the world—an error which is dero-

* Liebig *On the Chemistry of Food*: 1847. Liebig *On the Motion of the Juices*, &c.: [illegible].

† By W. Gregory, M.D., Professor of Chemistry in the University of Edinburgh.

gatory to the dignity of science, and must militate against an author's claim for permanent renown.

It is somewhat difficult to give a distinct idea of the contents of such a book as that *On the Motion of the Juices*, especially without the aid of diagrams; but as far as this can be done, we will do our best. It purports to be an inquiry respecting the motion of the sap in vegetables, and the motion of the juices of the animal body from the stomach to the lungs and skin. To explain this very mysterious motion, the following simple illustration is given:—

> Take a horseshoe-shaped tube, fill it with pure water, close both ends with bladder, and then place one end in a vessel containing brine, coloured blue. We observe, after a few hours, that a blue stratum forms within the tube, which constantly increases, till at last the brine is all drawn up into the tube. . . . . Bile or oil will be drawn up in the same way. This is effected by the evaporation of the water through the bladder, which is exposed to the air; and as this evaporation goes on, the brine is gradually forced through the other bladder. . . . The quickness of this process is directly proportionate to the rapidity of evaporation, and consequently to the temperature and hygrometric state of the atmosphere. That the skin of animals and the cutaneous transpiration, as well as the evaporation from the internal surface of the lungs, exert an important influence on the vital processes, and thereby on the state of health, has been admitted by physicians ever since medicine has existed; but no one has hitherto ascertained precisely in what way this happens. . . . . . The result of the previous investigations would seem to be, that one of the most important functions of the skin consists in the share which it takes in the motion and subdivision of the fluids of the body. The surface of the body of a number of animals consists of a covering or skin, permeable to liquids, (like the bladder in the experiment,) from which, when in contact with the atmosphere, an evaporation of water, according to the hygrometric state and temperature of the air, constantly goes on. If we now keep in mind that every part of the body has to sustain the pressure of the atmosphere, and that the gaseous fluids and liquids contained in the body oppose to the pressure a perfectly equal resistance, it is clear that, by the *evaporation from the skin and lungs, these parts lose their moisture, which is again drawn by capillary attraction from the part beneath*—thus causing a steady flow towards the surface. This close connexion, which the previous remarks show to exist between the pressure and hygrometric state of the atmosphere and the motion of the vital animal juices, at once explains the influence which a residence in dry or moist air, at great elevations, or at the level of the sea, may exert on the health. . . . . The blistering of the skin and the sun-burning to which men are exposed at great elevations, arise from the extraordinary dryness of the air, the increased evaporations, and the pressure by which the fluids, filling the vessels, are forced towards the surface.
>
> In a precisely similar manner is the sap forced up the stems of trees, &c. By the evaporation of the water from the surface of their leaves a vacuum arises within them, in consequence of which water, and matters soluble in water, are driven inwards, (through their roots,) and forced upwards. . . . . It has been ascertained that this pressure is nearly equal to that with which the blood moves in the great femoral artery of the horse.

As it has been shown that the suppression or retardation of the evaporation of the moisture from the skin of animals, whether it be caused by neglect of cleanliness, atmospheric changes, or any other cause, is always injurious to their health, so, in like manner, plants suffer if exposed to similar inconvenience; and Liebig shows, by a quotation from Hales, (an author of the last century,) that in all probability the blight and fireblast in hops are caused either by checked evaporation in the one instance, or by increased evaporation in the second. In Liebig's opinion the potato blight has precisely a similar origin.

In the districts which were most severely visited by the so-called potato disease in 1846, damp cold rainy weather followed a series of very hot days, and in 1847 cold and rain came on after continued drought in the beginning of September, exactly at the period of the most luxuriant growth of the potatoes. . . . . . No trace of disease appeared in spots fully exposed to a current of air. . . . . The cause of this disease is precisely the same which in spring or autumn excites influenza; that is, the disease is the effect of the temperature and hygrometric state of the atmosphere, by which, in consequence of the disturbance of the natural evaporation, a check is suddenly given to the motion of the fluids, which is one condition of life, and which thus becomes insufficient for the purpose of health, or even hurtful to the individual. The fungi, which have been observed on the potato plants, and the putrefaction of the tuber, are not the signs of a disease but the consequences of the death of the plant."

In the last remark we cordially agree, and hope that a few years will effectually dispel all fear respecting the potato crop.

It is somewhat remarkable that Dr Klotzch of Prussia should have arrived at a similar conclusion respecting the potato disease, from rather different arguments: he has placed his plan for a remedy in the hands of the Prussian government, and is to receive £300 if successful. He says the chief points to be attended to are—

1st, To increase the power of the roots; and—

2d, To check the transformation which occurs in the leaf.

Both ends are obtained simultaneously if, in the 5th, 6th, and 7th week after setting the tubers, and in the 4th and 5th week after planting out germs furnished with roots, or at a time when the plants reach the height of 6 to 9 inches above the soil, we pinch off the extreme points of the branches or twigs to the extent of half an inch downwards, and repeat this on every branch or twig in the 10th or 11th week, no matter at what time of the day.

It would be too tedious to detail the very learned arguments by which Dr Klotzch proves that this remedy *cannot* fail. He says that the expense is only 1s. 6d. per acre in Germany, and that the potatoes are improved both in quantity and quality, by the simple method above described. Though we may have little fear that such a recurrence of evils will again affect the potato crop, yet, should Dr Klotzch's plan prove efficacious, it cannot be too widely circulated, as it has both cheapness and simplicity to recommend it. M. B.

*Cooked Food for Fattening Cattle.**—Boiled turnips or steamed potatoes were found, by experiment, not to fatten cattle so well as those roots given raw. Even the advantage derived from oil-cake did not compensate for the expense of cooking those roots. Linseed, however, when crushed and boiled to jelly, and mixed warm with boiled turnips and chopped straw, has recently been found to fatten cattle and other stock very fast and very profitably. It is the object of Mr Harkness, in his little brochure, to describe the methods of using linseed in the principal feeding districts of Great Britain, and he has done so very distinctly.

* [illegible] *Preparation of Cooked Food for the Fattening of Cattle.* By Thomas Harkness. [illegible] Edition. 18[illegible]. W. Blackwood and Sons.

TABLE OF PRICES, &c.

The Average Price of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1848.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 5.	53 5	32 6	23 3	31 2	46 3	37 5
12.	54 4	31 10	23 4	31 0	47 10	36 6
19.	52 9	32 3	23 10	30 0	45 4	36 11
26.	52 10	32 4	22 0	30 2	43 11	35 0
March 4.	50 11	31 9	21 2	29 7	43 5	35 3
11.	51 6	31 0	20 10	30 6	41 4	33 11
18	51 7	31 3	21 7	30 9	40 3	34 4
25.	52 6	31 7	21 2	30 4	38 6	33 3
April 1.	54 2	32 10	20 7	29 0	36 0	32 10
8.	54 2	33 3	20 0	29 4	37 8	31 10
15.	52 9	33 4	20 1	29 0	34 9	35 3
22.	50 7	32 11	19 5	29 2	40 4	31 7
29.	57 6	32 9	20 6	28 9	38 7	33 2
May 6.	52 2	33 10	19 10	28 10	35 7	33 3
13.	52 6	33 3	20 3	29 6	36 4	33 6
20.	50 10	34 5	20 5	29 8	36 11	34 2
27.	51 4	34 1	21 7	29 9	38 3	33 3

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1848.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 2.	53 5	33 5	24 7	33 10	33 0
9.	53 10	33 5	24 7	33 10	33 4
16.	51 6	32 0	23 5	34 0	33 9
23.	51 2	31 9	22 6	32 11	32 6
March 1.	50 7	31 2	23 8	32 9	32 1
8.	50 6	30 9	25 0	33 6	33 0
15.	52 11	31 9	24 8	33 5	32 10
22.	53 2	32 0	25 0	32 8	32 0
29.	50 1	32 7	24 3	31 6	31 0
April 5.	51 2	31 10	24 6	33 6	33 0
12.	51 10	33 3	24 1	31 9	31 0
19.	53 7	34 3	24 2	34 1	33 4
26.	52 11	34 9	22 11	33 6	32 10
May 3.	53 0	34 3	23 2	33 7	32 9
10.	52 1	33 9	23 5	34 6	33 10
17.	54 2	34 5	23 6	34 5	33 6
24.	53 6	34 7	22 10	34 7	33 8
31.	53 7	34 11	23 4	35 3	34 6

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1848.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 5.	51 1	30 9	23 3	31 4	51 8	45 7
12.	50 6	31 9	20 11	30 10	50 6	38 7
19.	49 7	32 4	19 11	30 5	51 3	39 0
26.	48 2	33 3	20 5	30 1	48 4	37 2
March 4.	50 4	34 8	19 4	29 8	44 6	40 3
11.	51 2	30 8	20 3	29 10	44 0	35 1
18.	51 0	27 2	23 0	30 3	42 0	33 7
25.	50 8	32 9	20 0	30 6	40 4	35 5
April 1.	51 9	32 8	20 8	29 4	37 2	36 1
8.	50 1	28 5	19 8	29 6	38 4	39 0
15.	48 4	33 0	20 7	30 0	39 2	40 0
22.	48 9	32 8	19 9	29 8	38 6	34 9
29.	51 2	32 2	19 2	29 2	37 10	34 7
May 6.	50 5	31 6	19 8	28 9	38 4	35 2
13.	47 5	30 7	20 0	29 4	39 2	34 0
20.	48 10	30 10	20 1	29 10	38 5	35 6
27.	49 11	31 4	20 5	29 8	39 6	34 10

DUBLIN.

Date.	Wheat.	Barley.	Rice.	Oats.	Flour.
1848.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 4.	27 10	15 3		11 1	16 6
11.	27 7	15 5	14 0	10 5	16 4
18.	25 10	15 8	13 5	10 0	16 0
25.	26 4	15 0	13 6	10 4	16 4
March 3.	27 9	16 1	13 10	11 0	16 4½
10.	27 2	16 4	14 3	10 8	16 6
17.	27 6	15 6	14 0	10 10	16 6½
24.	25 11	14 1	13 6	10 11	16 5
31.	27 4	14 11	13 10	10 10	16 4
April 7.	27 5	13 7	12 6	10 10	16 6
14.	26 9	15 3	13 2	10 11	16 3
21.	28 7	14 10	13 6	10 8	16 2
28.	27 11	15 5	14 4	10 9	16 5
May 5.	27 7	14 6	13 10	10 7	16 6
12.	28 10	14 7	13 9	11 0	16 8
19.	29 3	15 6	14 3	11 9	16 10
26.	31 1	15 9	14 10	12 7	16 10

[TA]BLE showing the Weekly Average Price of GRAIN, made up in terms of 7th and 8th Geo. IV., c. 58, [a]nd 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties payable on FOREIGN CORN: the Duties payable thereon, from February 1848 to June 1848.

Date.	Wheat. Weekly Average.	Wheat. Aggregate Average.	Wheat. Duty.	Barley. Weekly Average.	Barley. Aggregate Average.	Barley. Duty.	Oats. Weekly Average.	Oats. Aggregate Average.	Oats. Duty.	Rye. Weekly Average.	Rye. Aggregate Average.	Rye. Duty.	Pease. Weekly Average.	Pease. Aggregate Average.	Pease. Duty.	Beans. Weekly Average.	Beans. Aggregate Average.	Beans. Duty.
1848.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
[F]eb. 5.	51 2	52 11	..	30 9	30 11	..	20 7	20 11	..	32 6	30 8	..	42 9	44 9	..	38 5	39 3	..
12.	51 0	52 5	..	31 2	30 10	..	20 6	20 11	..	30 5	30 9	..	43 2	44 6	..	38 1	38 11	..
19.	50 11	51 11	..	31 3	30 9	..	21 1	20 11	..	32 4	30 11	..	42 5	43 10	..	37 10	38 5	..
26.	50 2	51 5	6 0	30 9	30 10	2 6	20 8	20 10	2 6	30 3	31 1	2 6	41 7	43 1	2 6	38 0	38 3	2 6
[M]ar. 4.	49 11	50 10	7 0	30 8	30 11	2 6	20 5	20 9	2 6	30 5	31 2	2 6	41 8	42 6	2 6	36 9	37 11	2 6
11.	50 2	50 7	7 0	30 4	30 10	2 6	20 2	20 7	2 6	33 4	31 6	2 6	39 0	41 9	2 6	36 2	37 6	2 6
18.	50 4	50 5	7 0	30 5	30 9	2 6	20 4	20 6	2 6	28 6	30 10	2 6	39 10	41 3	2 6	36 3	37 2	2 6
25.	51 4	50 6	7 0	30 11	30 9	2 6	20 4	20 7	2 6	30 4	30 9	2 6	38 2	40 5	2 6	35 5	36 9	2 6
[A]pril 1.	51 10	50 7	7 0	31 5	30 10	2 6	20 2	20 4	2 6	29 8	30 5	2 6	36 4	39 5	2 6	35 7	36 4	2 6
8.	51 6	50 10	7 0	32 2	31 0	2 0	19 7	20 2	2 6	29 6	30 4	2 6	38 3	38 11	2 0	35 3	35 11	2 0
15.	49 7	50 9	7 0	32 2	31 3	2 0	19 11	20 1	2 6	28 1	30 0	2 6	36 11	38 1	2 0	35 6	35 8	2 0
22.	48 10	50 7	7 0	32 1	31 6	2 0	19 8	20 0	2 6	29 7	29 5	2 0	38 2	37 11	2 0	35 3	35 6	2 0
29.	49 6	50 5	7 0	31 10	31 9	2 0	19 8	19 11	3 0	29 0	29 6	2 0	37 6	37 7	2 0	34 9	35 4	2 0
[M]ay 6.	50 1	50 3	7 0	32 4	32 0	2 0	19 8	19 9	3 0	31 11	29 9	2 0	36 3	37 3	2 0	35 7	35 4	2 0
13.	49 10	49 11	8 0	32 8	32 3	2 0	20 2	19 8	3 0	29 10	29 8	2 0	35 9	37 2	2 0	35 6	35 4	2 0
20.	48 4	49 4	8 0	32 7	32 5	2 0	20 4	19 1	3 0	29 2	29 9	2 0	35 10	36 9	2 0	36 2	35 6	2 0
27.	47 8	49 1	8 0	32 8	32 4	2 0	20 8	20 0	2 6	28 9	29 8	2 0	36 11	36 8	2 0	36 9	35 8	2 0

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Date.	Markets.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
1848.		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb.	Danzig	40 to	46	22 6	28	15	20	23	28	28 6	35	28	34
March.		41	48	20	25	14	18 6	20	26	28	32	26	32
April.	—	36 6	42 6	16	24	14	17 6	18 6	25	27 6	30 6	24	30
May.		36	40 6	16	23 6	13 6	17	18	24	26	30	23	29 6
Feb.	Hamburg	40	47	20	28 6	15	19	24	29	32	38	28 6	35
March.		37	45	16 6	27	14	18	22	28	30	35	26	32
April.	—	36	40 6	16 6	25	14	18 6	20	26	28	32	26	30
May.		36 6	41	18 6	26	14	18	21 6	27	26 6	32	26	30
Feb.	Bremen	40	45	24	30	13	16	20	25	29	36	30	36
March.		38 6	43	22	28	14	16 6	18	23	27 6	34	30 6	37
April.	—	37 6	42	21	27 6	13	15 6	17 6	22	26 6	30	28 6	35
May.		38	43	22	29	14	17	18	24	27	32	26	33
Feb.	Königsberg	35	42	20	28 6	14	18	20 6	28	28	34	28	32
March.		34	40	18	26	13 6	17	20	27 6	28 6	35	26	30 6
April.	—	33	39 6	16 6	24 6	13	15 6	18 6	26	27	33 6	25	30
May.		35	41 6	17 6	25	14 6	17 6	18	25	28	34	26 6	32

Freights from the Baltic, 3s. 3d. to 5s. 3d.; Mediterranean, 6s. 6d. to 9s. per imp. qr.
The quantity of Grain of all kinds imported into Great Britain between the 5th January 1847, and the 5th January 1848, is 9,025,697 quarters, and the quantities of Flour and Meal 258,487 cwt.

THE REVENUE,
From 5th April 1847 to 5th April 1848.

	Quarters ending April 5.		Increase.	Decrease.	Years ending April 5.		Increase.	Decrease.
	1847.	1848.			1847.	1848.		
	£	£	£	£	£	£	£	£
Customs......	4,447,673	4,392,650	..	55,023	18,796,620	17,960,275	..	836,345
Excise........	1,652,865	2,002,601	349,736	..	12,547,657	12,080,482	..	467,175
Stamps.......	1,817,282	1,618,668	..	198,614	7,062,828	6,760,932	..	301,896
Taxes........	130,892	143,902	13,010	..	4,257,158	4,347,531	90,413	..
Post-Office....	219,000	221,000	2,000	..	820,000	866,000	46,000	..
Miscellaneous	129,593	77,307	..	52,286	430,161	209,640	..	220,521
Property Tax	2,033,072	2,041,640	8,568	..	5,464,581	5,450,369	..	5,212
	10,430,377	10,497,768	373,314	305,923	49,379,005	47,675,229	136,413	1,831,149
	Deduct Decrease		305,923		Deduct increase			136,413
	Increase on the qr.		67,391		Decrease on the year			1,694,736

TABLES OF BUTCHER-MEAT.

Date.	LONDON. Per Stone of 14 lbs.		LIVERPOOL. Per Stone of 14 lbs.		NEWCASTLE. Per Stone of 14 lbs.		EDINBURGH. Per Stone of 14 lbs.		GLASGOW. Per Stone of 14 lbs.	
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1848.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d.
Feb.	7 to 8	8 to 9 3	7 to 8	7 6 to 8 6	7 to 8	7 to 8	6 9 to 7 9	7 to 8	7 to 8	7 3 t
March.	7 3 8	8 9 6	6 9 7 6	7 9 9 0	6 6 7 6	7 3 8 3	6 6 7 6	7 3 8	6 6 7 6	7 6
April.	6 3 7 6	8 9 3	6 6 7 3	8 6 9 4	6 7	7 6 8 6	6 7	7 6 8 3	6 6 7 3	7 6
May.	6 7 9	8 9 6	6 7	8 4 9 6	5 6 7	7 3 8 3	5 9 7	7 3 8	6 9 7 6	7 9

[illegible] and Scotch WOOL.

[illegible]		
		[illegible]
[illegible]		14 6
in grea[illegible],	[illegible]	1
[illegible]outh Down,	11 [illegible]	[illegible]4 6
[illegible]alf-Bred,	1[illegible]	3
[illegible]eicester Hogg,	[illegible]	1 8
Ewe and Hogg,	9	10 6
[illegible]ocks,	5 3	7
[illegible]	4 3	6

Scotch, per 14 lbs.

	s. d.		s. d.
Leicester Hogg,	10	to	12
Ewe and Hogg,	8 6		10 6
Cheviot, white,	7		10
Laid, washed,	5		8
unwashed,	4		7
Moor, white,	4 9		6 8
Laid, washed,	3 9		5
unwashed,	3		4

IARS PRICES of the different COUNTIES of SCOTLAND, for Crop and Year 1847, by the Imperial Measure.

ABERDEENSHIRE.

	Imp. qr.
, without fodder	50/
with fodder	
, without fodder	28/9
with fodder	34/9
First, without fodder	27/10
—— with fodder	33/10
econd, without fodder	26/11
—— with fodder	32/11
otato, without fodder	21/
—— with fodder	28/
hite, without fodder	20/
—— with fodder	27/
- - - - -	28/
- - - - -	28/
- - - - -	60/
l, per 140 lbs.	15/8

ARGYLE.

- - - - -	49/4
- - - - -	31/4
- - - - -	28/
- - - - -	22/8
- - - - -	34/8
l, per 140 lbs.	18/8½

AYR.

- - - - -	50/3¼
- - - - -	29/6½
- - - - -	27/11
- - - - -	19/5
- - - - -	37/10
- - - - -	38/5½
l, per 140 lbs.	17/3

BANFF.

- - - - -	55/3
, with fodder	32/6
- without fodder	28/
First, with fodder,	28/6
—— without fodder	24/
econd, with fodder	26/
—— without fodder	21/6
otato, with fodder	26/8
—— without fodder	21/2
ommon, with fodder	26/1
—— without fodder	20/7
nd Beans	28/
o evidence.	
l, per 140 lbs.	15/2

BERWICK.

- - - - -	51/4¾
, Merse	30/2¼
Lammermuir	27/1
Merse	24/1½
Lammermuir	22/6¼¾
- - - - -	39/10
l, per 140 lbs.	18/11½

BUTE.

- - - - -	48/7
- - - - -	28/10¼
- - - - -	26/7¾
- - - - -	22/6¼
- - - - -	
- - - - -	35/8
l, per 140 lbs.	17/9

CAITHNESS.

- - - - -	26/10½
- - - - -	26/3
otato	
arly Angus	20/8
opeton	
un	21/1
lack	
l, per 140 lbs.	16/9

CLACKMANNAN.

	Imp. qr.
Wheat	53/6
Barley, Kerse	31/7½
—— Dryfield	29/11¾
—— Muirland, no evidence.	
Oats, Kerse	22/7½
—— Dryfield	23/6¾
—— Black, no evidence.	
Pease and Beans	35/6
Malt	55/5½
Oatmeal, per 140 lbs.	18/

DUMBARTON.

Wheat	49/10
Barley	30/11
Bear	29/
Oats	23/1
Pease and Beans	37/5
Oatmeal, per 140 lbs.	18/4

DUMFRIES.

Wheat	57/
Barley	31/4
Bear	29/
Oats, White	22/
—— Potato	23/
Pease, Gray, no evidence.	
Rye	32/8
Beans	44/
Malt	68/
Oatmeal, per 140 lbs.	18/1½

EDINBURGH.

Wheat, First	51/6
—— Second	46/
Barley, First	31/6
—— Second	28/
—— Third	26/
Oats, First	24/6
—— Second	22/
Pease and Beans	35/2
Oatmeal, per 112 lbs.	14/4
—— 280 lbs.	35/10

ELGIN AND MORAY.

Wheat	54/5
Barley	28/3
Oats	21/7
Pease	34/7½
Rye	30/5
Oatmeal, per 112 lbs.	13/8

FIFE.

Wheat, White	52/1¾
—— Red	49/
Barley	28/10¼
Bear	26/10¼
Oats	22/0¼
Pease	30/8¾
Beans	32/8½
Rye	30/2
Malt	53/6¼
Oatmeal, per 280 lbs.	32/10¼

FORFAR.

Wheat	52/8
Barley	27/2
Bear	24/9
Oats, Potato	21/10
—— Common	21/6
Pease and Beans	29/1
Rye	28/5
Oatmeal, per 140 lbs.	16/4

HADDINGTON.

Wheat, First	59/6¾
—— Second	55/0¾
—— Third	51/6½
Barley, First	34/10¼
—— Second	32/10½
—— Third	31/5¼

HADDINGTON (Continued.)

	Imp. qr
Oats, First	26/11
—— Second	25/2
—— Third	23/4¾

INVERNESS.

Wheat, without fodder	54/6
—— with fodder	61/
Barley, without fodder	27/8¼
—— with fodder	32/2¾
Bear, without fodder	26/
—— with fodder	30/6
Oats, without fodder	22/7
—— with fodder	28/1
Oatmeal, per 112 lbs.	15/7

KINCARDINE.

Wheat, without fodder	54/9
—— with fodder	64/9
Barley, without fodder	26/11
—— with fodder	33/11
Bear, without fodder	25/0¼
—— with fodder	32/0½
Oats, White, without fodder	20/9
—— with fodder	28/9
—— Potato, without fodder	21/6
—— with fodder	29/6
Pease, without fodder	26/8
—— with fodder	36/8
Beans, without fodder	28/8½
—— with fodder	38/8½
Oatmeal, per 140 lbs.	16/7

KINROSS.

Wheat	49/6
Barley, First	28/
—— Second	25/
Bear	
Oats, White, First	22/6
—— Second	20/
—— Black, First	17/
—— Second	15/6
Pease and Beans	30/5
Oatmeal, per 140 lbs.	17/3

KIRKCUDBRIGHT.

Wheat	54/6
Barley	30/10
Bear	28/
Oats, Potato and Hop	22/
—— Common	20/2
Beans	45/
Rye	34/
Oatmeal, per 140 lbs.	17/1

LANARK.

Wheat, First	52/6¾
—— Second	49/5½
Barley, First	30/4¾
—— Second	29/3¼
Bear, First,	29/9¾
—— Second	26/
Oats, First	22/5½
—— Second	20/9
Pease	39/9½
Beans	36/10
Malt	55/4
Oatmeal, First, per 140 lbs.	18/0 1/12
—— Second	17/9

LINLITHGOW.

Wheat	52/5
Barley	30/9
Oats	23/10
Pease and Beans	35/3
Malt	53/5
Oatmeal, per 140 lbs.	18/

NAIRN.

Wheat	54/
Barley, with fodder	32/

FIARS PRICES—*Continued.*

NAIRN, (Continued.)

	Imp. qr.
Barley, without fodder	27/6
Oats, with fodder	28/6
—— without fodder	22/
Oatmeal, per 112 lbs.	14/

ORKNEY.

Bear, per 360 lbs.	17/1
Malt, per 140 lbs., with duty	19/1½
—— per 140 lbs., without duty	10/10¾
Oatmeal, per 140 lbs.	13/6

PEEBLES.

Wheat,	48/8
Barley, First	31/6
—— Second	30/2
—— Third	29/2
Oats, First	23/11
—— Second	23/0¾
—— Third	22/
Pease, First	45/
—— Second	42/6
—— Third	38/
Oatmeal, First	18/0¾
—— Second	17/8¾
—— Third	17/5

PERTHSHIRE.

Wheat, First	55/9½
—— Second	46/1
Barley, First	27/9½
—— Second	23/
Oats, First	23/
—— Second	19/
Pease and Beans	30/4½
Rye	25/8½
Oatmeal, per 140 lbs.	17/7

RENFREW.

	Imp. qr.
Wheat, First	51/10¾
—— Second	50/8¼
Barley, First	31/5¾
—— Second	30/0¾
Bear, First	29/3¾
—— Second	27/2¾
Oats, First	23/2
—— Second	22/7
Beans, First	37/9
—— Second	37/2¾
Pease	35/3
Oatmeal, per 140 lbs. First	17/8¾
—— Second	17/8¼

ROSS AND CROMARTY.

Wheat, First	50/11
—— Second	46/6
Barley	28/2
Bear	23/
Oats, First	23/7
—— Second	23/0¾
Pease,	35/6
Beans	32/5¾
Oatmeal, per 280 lbs.	35/10
Barley Meal, 280 lbs.	28/6

ROXBURGH.

Wheat	53/8
Barley	29/11 $\frac{8}{12}$
Oats	24/2 $\frac{5}{12}$
Rye	
Pease	40/1 $\frac{5}{12}$
Beans	39/4 $\frac{8}{12}$
Oatmeal, per 140 lbs.	18/4

SELKIRK.

Wheat	
Barley	
Oats, Potato	
—— Common	
Pease	
Oatmeal, per 280 lbs.	

STIRLING.

Wheat	
Barley, Kerse	
—— Dryfield	
Oats, Kerse,	
—— Dryfield	
—— Muirland	
Pease and Beans	
Malt	
Oatmeal, per 140 lbs.	

SUTHERLAND.

Wheat	
Barley	
Bear	
Oats, Potato	
—— Common	
Pease	
Rye	
Oatmeal, per 140 lbs.	

WIGTOWN.

Wheat	
Barley	
Bear	
Oats, Potato	
—— Common	
Malt	
Rye	
Pease	
Beans	
Oatmeal, per 280 lbs.	

We may inform our English readers, that Fiars Prices are the average prices of grain, as ascertained every ye[ar by the] verdict of Juries, in every County of Scotland. The Juries are summoned in spring, and ascertain, from the [evidence] produced to them, the average prices of the preceding crop. By these prices, rents payable in grain, and similar [contracts] are generally determined; but the main object is to convert into money the stipends (for the most part fixed at [a certain] quantity of grain) of the Scottish Clergy.

ON THE SOCIAL AND POLITICAL INFLUENCE OF SMALL HOLDINGS.*

"GENERATIONS pass," says Sir Thomas Browne, "while some trees stand, and old families last not three oaks;" and it is nobly and truly, though not newly, said.

The reflection, indeed, and the melancholy moral at which it points, are amongst the oldest of those which have passed current among mankind. The "cold consolations" with which "the students of perpetuity" must content themselves, have been the proverbs of every age and of every tongue. Still they have not extinguished, and never will extinguish, the desire to be remembered, which is but another manifestation of the desire to be. They are scarcely more numerous than those which point at the worthlessness of life; and the converts to historical have probably been even fewer than those to corporeal suicide. That "Thersites is like to live as long as Agamemnon" we cannot deny, but still we are by no means reconciled to the worthlessness of immortality; for, although that which has been bestowed upon him is of a kind least of all to be envied, we are forced, against our better judgment, to regard it as some slight compensation for the prolonged indignity which he suffers. It is one attribute, at least, which he has in common with the king—one portion of the doom of the unworthy has not been visited upon him—he has not been forgotten!

But if "perpetuity of naked nominations," apart from those "deserts and noble acts which are the balsam of our memories," be thus an object of unreasoning but universal ambition, there is also a particular form in which this ambition has, more than in any other, sought for its gratification. We refer to the desire for the possession of the soil. In the eyes of men, in every age and country, a certain permanence and respectability has attached to the persons and families of those who possess a portion, however small, of the land in which they dwell. Something of the imperishable nature of the possession seems to be communicated to the fortunes of the possessor: the source of his prosperity appears less evanescent than ordinary wealth, and, in the eyes of the vulgar, he is sheltered at once from the caprices of fortune. Nor is the idea entirely erroneous. Its general accuracy may be seen from contrasting the fate of the great landed families, which form the landmarks of society in our country, with that of the rich merchant families, which, if not absorbed into their body, have invariably been swept away by the current of some mercantile misfortune. But it is even

* *A Plea for Peasant Proprietors, with Outlines of a Plan for their Establishment in Ireland.* By WILLIAM THOMAS THORNTON. 1848.
On Large and Small Farms, &c. By H. PASSY, Peer of France, &c. &c. 1848.
An Essay on the Improvement to be made in the Cultivation of Small Farms, by the Introduction of Green Crops, &c. By WILLIAM BLACKER, Esq.
Principles of Political Economy. By JOHN STUART MILL. 1848.

more apparent when we compare the peasant proprietors of Germany with the inhabitants of the towns. The former are not, like our landed gentry, the objects of envy to the burgher population, and are consequently but rarely recruited from their ranks, and still they continue in their humble possessions till many of them attain an antiquity equal to that of our oldest families, whilst in the towns the wheel of fortune maintains an unceasing revolution.

Strange though it may seem at first sight, we believe it to be a fact, that the least permanent landed class in Europe is that of our own smaller gentry. We have no statistical tables to quote in proof of the assertion, but we believe that, on reflection, its accuracy will be borne out by the experience of most of our readers. Nor is it difficult to explain how the phenomenon occurs. From the preference for country life which has ever formed an amiable peculiarity in English character, and from the high social consideration which consequently belongs to the position of a country gentleman amongst us, many persons are tempted prematurely to enrol themselves in the favoured class. Estates are thus purchased with inadequate means, and, burdened in the hands of the original proprietors, they are handed down to his posterity more burdened still. A style of living, in the mean time, is too frequently adopted, consistent, not with the actual circumstances of the possessor, but with the income which he would have derived from his estates had they been unencumbered; for the wealth of a landed proprietor, in the eyes of the world, is invariably measured by the often most fallacious standard of the rents which he receives. Such a course, once entered upon, is not easily abandoned. Pride, indolence, and habit lead to its continuance. Ignorance with regard to the real state of matters is not confined to the public—it extends to the friends and associates of the proprietor, to the members of his own family, and even to himself. For the respectability of his children, and their advancement in life, it is necessary that he should continue to hold his place in society. Their success depends, in some measure, on their playing gracefully the part of persons of rank and fortune, and the surest and easiest means of enabling them to do so with confidence and effect, are to be found in permitting them to continue in the delusive belief that they really are such. The dark side of a man's affairs, besides, is a subject of conversation so thoroughly distasteful, both to himself and to others, that some excuse for shunning it is pretty sure to be found, and from day to day it is postponed to a more convenient season. Nor is it more inviting as an object of solitary contemplation. To think of it is as disagreeable as to talk of it, and a system of self-delusion is steadily practised. That a merchant should deceive himself with regard to the state of his affairs seems explicable enough—and, indeed, to arrive at an accurate knowledge of his positive wealth is often no easy matter—but that a landed proprietor, in whose

hands must be the means of putting the fallacy to flight every hour of the day, should do the same, seems to many incredible. Can he be ignorant, it is asked, of the number of bonds over his property, or of the interest which they carry? or is he insensible to the soft impeachment which is implied in those persevering proofs of their remembrance, which his tradesmen are daily transmitting to him through the post? Altogether ignorant he certainly is not. As an abstract proposition, he knows that he is in debt, but he knows it merely, he does not feel it as yet;—it is a truth which has no concrete existence for him, and consequently no living effect upon his conduct. He knows it, as he knows that Cæsar was in debt, or that the British nation is so. It is a misfortune, no doubt, but one which is to be borne—"C'est un malheur *comme un autre.*" He eats and drinks as heartily and as daintily as ever; his trees are as green and his lawns as smooth, his horse carries him as swiftly, and his gun is as unerring in its aim; over his broad fields he ranges unmolested—no stranger, as yet, may set foot on his domain; his servants are civil, and his friends are kind; hats are pulled off to him wherever he goes, and at the county meeting he has a seat upon the bench. If one tradesman will not serve him, another will; and, besides, tradesmen he has been accustomed from his youth to regard as the common enemy. To struggle with them is a portion of the lot of a gentlemen, to which he made up his mind when he was at college, many years ago. A "*dun,*" in his eyes, has ever since been a ludicrous monster, and the merriment which he affords him is no inconsiderable compensation for the annoyance which he occasions. He quotes Sheridan, and agrees that to pay him is immoral; for tradesmen are rascals, one and all, and to pay them is only to encourage their rascality. But the hour of payment is like the hour of death—to the gayest and the wittiest it must come at last; and if he escapes the plunder of his last blanket, he is more fortunate than the most graceful trifler who ever sported with debt. Even if the fates should favour him with a gentler lot, and if, like Louis XV., he should succeed in getting matters to last his time, in general it is only a prolongation of the struggle; and, through along and wasting trusteeship, his estates, unless screened by the now repudiated shelter of an entail, pass inevitably into another family.

In the case of a person of moderate fortune, which we here suppose, the regenerating expedients which save the larger proprietors and the nobility cannot be called into play. It is one thing to reduce an establishment which is magnificent, and quite another thing to reduce one which is simply comfortable, or even luxurious. Take one man with fifteen hundred, and another with fifteen thousand a-year. The habits of the two individuals, in so far as personal comfort and enjoyment go, will probably be pretty nearly on a par. The common indulgences of English gentlefolks are indispensable

to each, and by the man of hundreds they can be attained as well as by his richer neighbour. But let a reduction in the respective establishments of these two individuals become necessary—say that each shall be compelled to give up two-thirds of his income to his creditors—and the difference of their position will be felt. The poorer man had nothing more than was necessary to float a person of his habits, even in his time of prosperity, and now he is thoroughly aground. One by one his very comforts must be relinquished. He can no longer keep a carriage, his man-servant must be paid off, even wine of the better sorts has become an extravagance for him, and he is surrounded by a multitude of vulgar cares. The generous habits and refined tastes, which formerly it was his pride and his pleasure to cultivate, now stand like spectres in the way of his return to prosperity. Nor is it enough that he should unlearn the training of his former life. New habits suited to his altered situation must be be acquired—habits of economy, accuracy, thoughtfulness; in short, the whole character of the man must be formed anew. A task implying such a painful and continued effort of self-denial—and one imposed very frequently, be it remembered, not on one individual alone, but upon every member of a numerous family—is rarely, it may be supposed, performed well, and the penalty, viz., the sale of the estates, is consequently incurred. With his richer neighbour the case is very different. His vanity is all that he is called upon to sacrifice, for, with £5000 a-year, every comfort and luxury which he really enjoyed will still remain to him. The pomp and circumstance of a large establishment is all that he is called upon to forego, what he squandered upon others is all that he is required to save. The rude change penetrates not to his person or his family; and if he alters his residence, or betakes himself to the Continent for a time, his fortunes will retrieve themselves without effort on his part.

So familiar, indeed, is all this to the experience of most of us, that to mention it here may seem almost superfluous; its importance, however, will scarcely be denied, if we consider that it not only explains the social phenomenon of the instability of our smaller landed gentry, but that it also throws light upon the condition of many other classes of the community, and may even furnish us with a hint for the solution of the questions which more immediately occupy us here. We believe that the instability of the class to which we have alluded, so far from being an isolated and exceptional fact, is in strict conformity with a social law. In the bodily constitution, it is well known that the periods of danger are those of transition—that in the passage from youth to manhood, and from manhood to old age, the risk to life is greater than during the currency of either. Now, something analogous we take to be the case with regard to our fortunes. The ploughman runs small risk of poverty, whilst he is willing to earn his bread by his labour: his

critical period arrives when he endeavours to pass into the farmer class, immediately above him. The same holds true of the active and intelligent agriculturist. Even in times of agricultural depression, his circumstances rarely become involved to any very alarming extent; but no sooner does he purchase a small landed property than he gets upon slippery ground. He has abandoned the ranks of the producers, without being altogether able to hold his ground among the "nati consumere." It may be that, with the prudent habits of his former life, he could afford to live in his new position; but he forgets that the loss of these habits is one of the very earliest consequences which will result from the change, and that *no man is safe to attempt being idle until he can afford to be extravagant also.* If he wishes to place himself and his family securely and permanently in a higher class of society, he must be contented to remain in the one to which he belongs, till he is rich enough to leave it entirely behind him. He cannot combine the advantages of two classes of society; and if he would secure the good which may result from a change, he must be prepared to meet the evil also.

From these observations, it seems to us that a very important rule for estimating the relative value, socially and politically, of large and small holdings, presents itself. The rule to which we allude is, that, *whatever the size of the possession may be, and whatever may be the nature of the tenure by which it is held, it should be such as that it may be occupied by a person belonging to one or other of the acknowledged classes of society,* in the country in which he lives. Both for the prosperity of individuals, and for the culture of the soil, we believe that any division of land which shall violate this rule, and tempt to the assumption of the uncertain and equivocal position which we have described, is to be condemned. Keeping this principle in view, then, it will appear that the peasant allotment system, whether in lease or perpetuity, is preferable to that of *small* farms; whilst large farms, again, are to be preferred to small properties. Of the disadvantages of the latter we have already said what we conceive to be necessary—we have pointed out the chief causes which lead to the instability of our smaller gentry—and we shall now very briefly mention those which seem to us to militate against the system of small farms, as it has hitherto been practised in this country.

In the case of small farmers, we believe that ruin is, less frequently than among small proprietors, the result of personal extravagance. A change of habits seldom occurs in the first generation. A peasant who rents a small piece of ground, or a comfortable farmer who purchases an estate, seldom feels, in a social point of view, the inadequacy of his means to his altered position. He is scarcely admitted into the society of the class of persons to which he has joined himself; and he has, therefore, few temptations to abandon the frugal habits of his youth. It will be found that properties purchased in the manner we have supposed, generally

remain two or even three generations in the family: the art of spending, like that of saving, cannot be learned at once, and it is rarely acquired by the original purchaser.

The small farmer, for the most part, lives like a peasant—nay, in most instances, we believe, he lives worse; and, with the exception of one very unfortunate piece of pride, which all who know any thing of the class must have observed amongst them—we mean that of not permitting their children to go to domestic service—we believe that his failure is seldom to be attributed to riotous living.

But there is another cause of ruin which interferes, and which, in his case, usually prevents the experiment from being tried in a second generation — his capital is inadequate to the profitable cultivation of his land.

We believe it be altogether a golden rule, both for the individual occupant and for the community, that, whatever the size of the farm may be, it should be rather under than over that which the capital of the tenant will enable him to cultivate fully; and this rule, we believe, is more frequently violated, and is also more likely to continue to be violated, in the case of small farms, than either in allotments for spade husbandry or in large farms. We say that it is more likely to continue to be violated, because small farms are precisely the description of holdings which tempt the peasantry to a premature abandonment of their class. A farm of 40 or 50 acres, in ordinary circumstances, is almost certain to be rented by an ambitious ploughman. It does not afford scope for the enterprise of a person of the farmer class properly so called, and the buildings upon it are usually unsuited for the residence of a person of his habits. But, at the same time, to do justice to its culture, a capital of from £300 to £400 is requisite; for, according to the opinions of the best agriculturists, no man ought to possess less than £6 to £8 per acre of capital at the period of entering upon his farm. Now the sum we have mentioned, it will be admitted, is a very large one to be saved upon the wages of an ordinary ploughman, or even of an overseer or grieve. Supposing him to accumulate a third of his earnings, it would require the industry and frugality of a lifetime to bring it together. The consequence is, that in most cases his patience is exhausted, and the experiment is tried prematurely. With £150 or £200 in his pocket, he becomes the tenant of such a farm. He is frugal, industrious, and active, but his farm is imperfectly stocked and imperfectly manured: he sees around him, on the farms of his richer neighbours, improvements yielding in time an abundant return for the capital which they have cost, but which his poverty renders it impossible for him to introduce; and the consequence is, that his fields yield him but a scanty and inadequate return. A rent which, with a more generous culture, would not have been exorbitant, thus becomes to him an

insupportable burden; land which, to a more substantial tena might have been a source of profit, is inevitable ruin to him; a after an ineffectual struggle, prolonged during the best years his life, he descends, discouraged, and crestfallen, and pennile into the class from which he sprung. Nor does he descend uni jured in a moral point of view. During the period of his hope declension, it almost invariably happens that he has contract habits of recklessness and dissipation, which totally unfit him 1 the duties of a servant; and the consequence is, that from a pı sperous, and even wealthy peasant, he is reduced, by this unf tunate speculation, to be the inmate of a workhouse, or an out-dc pauper. Such cases we believe to be occurring every day; ma are known to ourselves, and many, we believe, will occur to o readers. Where small farms are inevitable, the only means which their proper culture may be in some measure secured, w be by landlords erecting upon them such steadings as will acco modate a person in better circumstances, and then making a str inquiry with regard to the capital possessed by intending occupan On the whole, however, we believe them to be a dangerous expe ment; and if we may venture, in a question depending upon many specialties, to suggest a rule with regard to the size of farr we should say, that if they are to exceed what a man can labc by spade husbandry alone, they ought to be of such extent as afford remuneration to a person who should not work at all, a whose occupation should consist in superintending the labours others. The question, however, of the relative advantages large and small farms, is one which, in our opinion, admits of such absolute solution as that which, on one side or the other, usually receives. It is a question which has been more keenly a more frequently canvassed than any other in rural economy, a still we believe, with M. Passy, that, "at the present day, t debate remains much as it was at starting." The dictum of Plii "Latifunda perdidere Italiam, et jam vero provincias," has again a again been reversed and affirmed; and every age, according to its ı cessities, has had its Young or its anti-Young, its Passy or its an Passy. They have each and all expressed, not an absolute, bu relative truth; and their error has lain in extending to all nations, all circumstances, an observation which was perfectly just a extremely valuable with regard to the particular nation, in t particular circumstances in which they contemplated it. Wł Pliny beheld the once flourishing and populous territories of t Roman people cultivated by slaves, and parcelled out among few wealthy and non-resident voluptuaries; and when he reflec that the *canaille* who then thronged the streets of Rome, demor ised and dependent, were the descendants of those who ł nourished in the fields that virtue which had enabled them conquer the world, it can scarcely be wondered at that he sho

have discovered something amiss in a system which had operated such a mournful change.

Nor is Arthur Young's condemnation of the opposite system less easily to be explained. At the period at which he wrote, the population of the towns had increased immensely beyond what it had been in the preceding century. Subsequent to the peace of Utrecht, the rapid advancement which England had made in manufactures and commerce had led to the formation of great industrial works, and even whole towns had been called into existence by this new current of affairs. The question of the age was, How is this newly created population to be fed? The ancient system of cultivation, which had sufficed to support a smaller population, was now altogether inadequate to the demands of the times, and improvements, which should enable the cultivator to derive from the soil something approaching to what nature had qualified it to yield, had become indispensable. But, at the same time, it was obvious that they could never be achieved by the then possessors of the soil. Capital, enterprise, and intelligence were alike awanting to them. Even the industry which can alone, in any circumstances, place the small farmer on an equality with the great one, they had not in excess; nor could it have been called into existence, except at the expense of a complete revolution in the whole system of land tenure in the country; for it is among peasant proprietors, and not among peasant farmers, that it alone compensates for the absence of skill and the division of labour. It was by extensive improvements alone that the sudden change could be brought about which the necessities of the times demanded, and these were beyond their reach. Gradually they might have been taught to cultivate their fields with greater industry or greater skill; and the increased sale which the growing population offered would have naturally led to this result; but to drain bogs, to reclaim waste land, to build thrashing-mills, and to manure effectively, required means which they did not possess. Arthur Young and others saw that such operations could be performed only by persons of greater substance, and of a higher class; and such persons soon began to find their profit in applying themselves to agricultural pursuits. The capital and skill which they brought to the task enabled them to produce a greater quantity of grain, at a smaller expenditure of labour, than the smaller farmers, and thus to drive them out of the market. Besides, although the system pursued by such persons required larger accommodation, and more expensive erections, it was found that the diminution of their number, consequent upon the great consolidation of farms, led to a still greater saving; and the smaller number, both of men and of horses, which were requisite after the introduction of a proper division of labour, diminished of course the local consumption, and enabled the cultivators to carry to market a greater quantity of alimentary substances for the use of

the classes engaged in other pursuits. There can be little doubt that, economically considered, *as matters then stood*, Arthur Young was right, and that the preference which he gave to the large farm system was given on good cause shown. But then, was he right with reference to all time?—or rather, (what it concerns us to know at present,) was he right with reference to *our* time? We believe that he was not, and that the exigencies of the present age still more imperatively call for an abandonment of his doctrines than those of his own did for their adoption. In the *Plea for Peasant Proprietors*, by Mr Thornton, and in the *Memoirs of M. Passy*, we have the opposite side of the question very ably supported; and in the former work we have, moreover, a very judicious application of the principles which it advocates to the exigencies both of England and of Ireland at the present day. Mr Thornton's work is one which, for many reasons, we have very great pleasure in recommending to the notice of our readers. It is altogether a gentlemanly and scholarly performance; clearly reasoned and correctly written, full of apposite illustrations, but not redundant—evidently the work of one whose brains have had the rinsing of a thorough education. Besides the intrinsic interest of the subject, it has much special interest for which we have to thank the author personally; and the reading of it is not, therefore, as is too often the case with books upon similar subjects, a bore which must be submitted to for the sake of the grain of truth which it may possibly contain.

It is particularly gratifying at the present time, when subjects connected with the subsistence of our people have assumed such an engrossing and painful interest, to see a writer possessing at once the acuteness and the popular talents of Mr Thornton, devoting himself to the task of suggesting measures, not of temporary, but of permanent relief; and we trust that in him, and in the school to which he belongs, a counterpoise will be found to the too great influence which has hitherto belonged in this country to the opposite theory.

The economical question he states thus: "When political economists speak of estates or farms as too small, they mean, either that the gross produce is less than it would otherwise be, or at least that a smaller portion is set apart for the use of the non-agricultural classes. When they say that an agricultural class is too numerous, they mean, either that it consumes food which should be reserved for other classes, or that its own wants are inadequately supplied."

Now, Mr Thornton undertakes to show—and we think he does show satisfactorily—that the gross produce arising from small farms in the hands of peasant *proprietors* is not only greater than that which would arise from the same extent of ground in the hands of extensive agriculturists; but, moreover, that after providing, and providing abundantly, for the wants of the greater agricultural

population which is maintained upon the soil, a *greater portion* is set apart for the use of the non-agricultural classes. He says—

The extent of cultivated land in Great Britain is estimated at nearly thirty-four millions of acres. The population in 1841 was 18,720,394 persons, of whom 22 per cent belonged to the agricultural class. The class so denominated, however, included not only the persons actually engaged in agriculture, but likewise their families, the number of the former being only 1,480,880, or about one-twelfth of the population; so that the numbers who, in the largest sense of the word, might be termed non-agricultural, was not less than 17,239,514. But these were not entirely dependent for subsistence on the produce of British soil. The quantity of grain annually brought to market in the United Kingdom is estimated at thirty millions of quarters, of which, previously to the repeal of the Corn Laws, about two millions, or one-fifteenth, came from abroad. This statement, it will be observed, applies to the whole of the United Kingdom. Of the grain brought to market in Great Britain alone, between two and three millions of quarters, equal probably to one-tenth of the entire quantity, were annually brought from Ireland; so that, supposing an equal proportion of other provisions to have been of transmarine production, one-tenth of the non-agricultural population may be considered to have been fed on imported provisions. The number of persons, exclusive of the cultivators, who subsisted on home produce, was between fourteen and fifteen millions, or one person to about every two acres and a half of cultivated land.

The proportion between the agricultural and other classes in the Channel Islands, is not stated by the late Census Commissioners, but all the other particulars required for a comparison with Great Britain are procurable. Jersey contains 26,600 acres of cultivated land. Her population in 1841 was 47,544; the number of persons engaged in agriculture 2392, or one-nineteenth of the whole; and the non-agricultural population, (using that term in the same extended sense as before,) 45,152. In the year 1835 foreign provisions were imported to the value of about £80,000; but whereas corresponding imports into Great Britain are purchased almost entirely with manufactured goods, in the Channel Islands they are to a large extent bartered for other agricultural produce. The exports of provisions from Jersey in 1835 were worth nearly £60,000,* so that the value of the net imports was little more than £20,000, which, even at the very low rate of £10 a-head, would suffice for the maintenance of only two thousand persons. Deduct this number from the non-agricultural population referred to above, and there will remain 43,152 persons over and above the cultivators to be fed with the produce of 26,600 acres. This is at the rate of four persons to every two acres and a half.

The results exhibited by Guernsey are still more striking. The cultivated portion of that island contains 10,240 acres; the total population in 1841 was 26,649; the number of cultivators 1,494, or rather less than one-eighteenth of the whole; and the non-agricultural residue 25,155. In the year 1834 foreign provisions were imported to the value of £81,400†; but provisions were exported to the value of

Imports.				Exports.		
* Wheat,	22,914 qrs. at	40s.	£45,828	Wheat,	4,694 qrs. at 40s.	£9,388
Barley,	2,369	25s.	2,9614	Potatoes,	211,559 lbs. at 1s.	10,577
Oats,	2,634	20s.	12,63	Cows,	1,135 at £10	11,350
Oxen,	2,784 at £6		6,740	Butter,	25,000 lbs. at 1s.	1,250
Sheep,	6,602	1	6,602	Apples,	224,611 lbs. at 6d.	5,615
Lambs,	1,243 at	10s.	621	Cider,	413,815 galls. at 1s.	20,690
Poultry,	28,821	2s.	2,882			
Eggs,	96,950 doz.	at 6d.	2,423			£58,870
			£80,655			

—*Guernsey and Jersey Magazine*, vol. iii. p. 106-9.

Imports.

† Wheat and flour,	21,955 qrs. at	40s.	£43,910
Barley,	6,295	25s.	7,868
Pease and Beans,	1,295	30s.	1,942
	Carried forward,		£53,720

£27,500, so that the value of the net imports was £53,900. This sum might suffice for the maintenance of between five and six thousand persons, leaving nearly 20,000, besides cultivators, to be fed with the produce of 10,240 acres. This is at the rate of very nearly five persons for every two acres and a half.

Thus it appears, that in the two principal Channel Islands, the agricultural population is in the one twice, and in the other three times, as dense as in Britain; there being in the latter country only one cultivator to twenty-two acres of cultivated land, while in Jersey there is one to eleven, and in Guernsey one to seven acres. Yet the agriculture of these islands maintains, besides cultivators, non-agricultural populations, respectively, four or five times as dense as that of Britain. This difference does not arise from any superiority of soil or climate possessed by the Channel Islands, for the former is naturally rather poor, and the latter is not better than in the southern counties of England. It is owing entirely to the assiduous care of the farmers, and to the abundant use of manure. The results of the comparison just made may be surprising to most English readers, but the Channel Islanders themselves are not insensible of the advantages they derive from their method of farming, and very reasonably congratulate themselves upon it. "There are larger estates in England," says the late bailiff of Guernsey, Mr Brock, "than the whole of this island, but where will one be found that produces the quantity of provisions sent to market by one small farmer? Let the production of the island be compared to that of any ten thousand acres kept in one, two, or three hands in Great Britain, and the advantage of small farms will be obvious. Independently of the two thousand families living in the country, compare the surplus produce sent to market with the surplus produce of any ten thousand acres in one, two, or three hands elsewhere, and see on which side the balance will be found.*

If such, then, be the actual state of matters, the question would

Imports.

	Brought forward,	£53,720
Cattle,	1,332 at £6	7,992
Calves,	240 at 30s.	360
Sheep,	6,358 20s.	6,358
Pigs,	73 20s.	73
Poultry,	47,14 at 2s.	714
Eggs,	13,972 doz. at 6d.	349
Potatoes,	1,788 bs. at 1s.	90
Butter,	101,980 lbs. at 1s.	5,099
		£81,400

Exports.

Wheat, flour, and biscuits,	4,669 qrs. at 40s.	£9,338
Barley,	859 25s.	1,073
Pease and beans,	524 30s.	786
Oats,	229 20s.	229
Cattle (Guernsey,)	506 at £10	5,060
Cattle (foreign),	8 6	48
Calves,	68 3	204
Pigs,	399 at 30s.	598
Eggs,	12,390 doz. at 6d.	309
Potatoes (and equivalent of potato spirit),	100,000 lbs. at 1s.	5,000
Apples,	1,824 bs. at 6d.	45
Cider,	29,410 galls. at 1s.	1,470
Pears,	12,175 bs. at 5s.	3,043
Butter,	5,380 lbs. at 1s.	269
		£27,472

—*Martins' British Colonies*, vol. v. p. 481-2. I have taken those years, both for Jersey and Guernsey, for which I had the fullest information. The quantities of butter are mistaken by Martin. In the table above they are given upon the authority of a paper obtained from the Guernsey Custom House.

* *Guernsey and Jersey Magazine*, October 1837, p. 258.

seem to be wellnigh settled in favour of the small peasant possessions.

But other tests of productiveness are not awanting. Rent being that portion of the produce of land which remains after the expenses of cultivation are deducted, it is evident that, if small farms pay the highest rent, they must also yield the largest surplus produce. Let us apply this to the Channel Islands, as compared with Great Britain.

"Thirty shillings an acre would be thought, in England, a very fair rent for middling land; but in the Channel Islands it is only very inferior land which would not let for at least £4, and in Switzerland the average rent seems to be £6 per acre."

If it be true, as we attempted to show in a former article,* that, notwithstanding the efforts by which the philosophers of the M'Culloch, Porter, and Macaulay school, endeavour to reconcile their minds to the fatalist doctrine, that the agriculturist class must and will necessarily decrease in numbers before the march of social improvement, this class is still the happiest, the healthiest, and the longest lived of those who gain their bread by labour within these islands, then must we hail with joy a system which promises to maintain an agricultural population three times as dense as that in England at present, whilst at the same time it furnishes to the squalid denizens of our manufacturing towns, not a smaller, but a larger supply of food. On the subject of the real value of the agricultural classes, and the necessity for their being regarded as possessing some value apart from that of merely producing food for the benefit of the rest of the community, Mr Thornton has the following very sensible remarks:—

> That is the best system of agriculture, not which provides for one class at the expense of another, but which insures the largest amount of happiness to all. The cultivators of the earth are not, as they are too often represented, little better than machines, whose business it is to raise food for the rest of mankind, and whose consumption of part of what they themselves produce is to be regretted as a national loss—a deduction from the source of national wealth—and is, consequently, to be restricted as much as possible. Their office is not—no matter by means of what self-privation—to provide the largest possible surplus produce for other classes; they are themselves, not less than artizans and manufacturers, constituent parts of the community, and it is essential to national welfare that they, equally with the others, should be maintained in plenty and comfort. Unless a considerable share of agricultural produce be reserved for classes not agricultural, civilisation is impossible; but national wellbeing is equally impossible if that share be excessively augmented at the expense of the cultivators. That is not the best system of agriculture which provides most abundantly for the former classes, unless it likewise provide adequately for the latter. Small farms might possibly be preferable to large ones, even though it should appear that a smaller surplus produce were sent from them to market.

The value of any measure which might tend to increase the

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* *Condition of the Agricultural and Manufacturing Population*, October 1847.

numbers of our rural population, might perhaps have been brought home even more strongly to the minds of his readers, if Mr Thornton had reminded them of the simple fact, that the life of one agriculturist is, on an average, quite as long as the lives of two manufacturers*—a fact which is also pretty instructive with regard to the comparative degrees of health and comfort which they respectively enjoy.

So much, then, for the productiveness of small properties: let us now see something of their social effects; and on this subject we shall, in the first place, permit one to speak to whose voice even the M'Cullochs and the Porters, and the rest of the peasant extirpators, cannot very consistently turn a deaf ear.

"A small proprietor," says Adam Smith, "who knows every part of his little territory, who views it with all the affection which property, especially small property, naturally inspires; and who, upon that account, takes pleasure not only in cultivating, but in adorning it, is generally of all improvers the most industrious, the most intelligent, and the most successful."

The very circumstance, indeed, that *industry* is the source from which the greater productiveness of peasant holdings is proved to arise, is in itself a very satisfactory guarantee for the social benefits of the system. A man who has every moment of his time occupied in a work in which he himself takes the liveliest interest, has no leisure for dissipation, and is rarely vicious. It is under the influence of idleness that the passions luxuriate, as weeds grow rank upon an uncultivated soil. Nor is he likely to be an insubordinate subject, or a bad citizen. Whilst he has abundant occupation on his own little farm, he will have no need for the excitement of Chartist Conventions, or of Conciliation Halls: so long as he enjoys comfort and plenty, as the rewards of his industry, he is scarcely likely to become an advocate for change. Smith has said that he is intelligent—and more intelligent than a labourer upon the fields of another he will most certainly become, from the greater incitement which he has to mental, as well as to bodily activity. The continual thought which he must take for the management and improvement of his little possession, for the sale of his produce, and for the procuring of his seeds, will save him from that mental torpor which too frequently takes hold of him who is a mere instrument in the hands of another. In speaking of the peasant proprietors of the Continent, Mr Laing remarks—"The labourer who possesses property, whether he can read and write or not, has an educated mind: he has forethought, caution, and reflection, guiding every action; he knows the value of restraint, and is in the constant habitual practice of it." In this respect, indeed, we believe the system to

* *Seventh Annual Report of the Registrar-General*, p. 338.

possess peculiar claims to favour, inasmuch as it tends directly to counteract an evil which exerts a very baneful influence upon the rural peasantry of this country. The inhabitants of towns, whatever their occupations may be, are guarded against mental inactivity by the continual contact into which they are brought with their fellow men, and the subjects of interest which must necessarily present themselves in a large community. Where many men are gathered together, some spirit is always to be found active enough to stir the waters, and accidental circumstances will occur to aid him in his task. But the hind, who, with the unvarying features of the same rural district ever before him, plods day after day to his solitary toil, who heedlessly performs the task which is assigned him by a superior, and who returns in the evening to the society of those whose mental exercises have been similar to his own, can scarcely be expected to escape a certain deadening of his faculties. If his love of excitement should remain, it will probably find gratification in "drinking at the Chequers;" and if it be extinguished, he will become, as we too often find him, even in middle life, perfectly sluggish and unimpressionable. Nor is this affection confined to the mind: the nervous system, for want of exercise, becomes relaxed, the body listless and inactive; a slouching and lumbering gait is contracted, and a premature old age creeps in upon him between his 50th and his 60th year. We have no doubt that, if peasant proprietors were established amongst us, statistical tables would very soon show them to be longer-lived than rural labourers who have no direct interest in the soil.

Nor would any class be more likely to procure for their children the benefits of education than those who, in their own persons, were daily experiencing the advantages of intelligence. The *cui bono*, by which the hind may well be pardoned for meeting all that can be said to him on the subject, would in their case have met with a practical answer; and the empty belly, which in the children of the artizan calls more imperatively for attention than the empty head, would here also be no impediment. A counteracting influence would no doubt arise, from the profit with which even very young children might be employed in working upon their little farms, and from the penurious habits which peasant proprietors are said very frequently to acquire. It is probable, however, that they would in time become aware of the fact, that their deficiency in intelligence not unfrequently counteracted the effects of their industry, and that the disadvantage at which they thus were placed, when competing with their wealthier and less industrious neighbours, was only to be removed by a more liberal instruction.

But there is another argument in favour of peasant proprietors which seems to us well worthy of consideration, although, so far as we have seen, it has not been touched upon by any of their advocates. If sufficiently numerous, they form for themselves a distinct

and recognised *class*, a resting-place for ambition between the lower and the upper classes of society. Their condition is subject to few of the objections which we have seen to apply to that of small farmers, and of the lower gentry. They escape the dangerous transition state, and their self-respect is spared the continual mortifications which must be borne by those who tack themselves on to the tail of a class to which they do not properly belong. It has often appeared to us a desideratum in the constitution of society in this country, that no means are offered to the labouring population of gratifying that honest pride, and desire for independence, which belongs to the character of every man whose spirit has not been broken by his degraded position. This love of independence is a feeling which is fast disappearing from amongst us, and which our miserable, though perhaps inevitable, system of poor-laws daily tends to diminish; yet it is the most powerful incitement to industry which nature has implanted in man, and the surest guarantee for good citizenship.

We believe that this view of the matter might in some measure tend to reconcile our great landed proprietors, and the upper classes generally, to the introduction of peasant proprietors. In countries where they exist, we do not find that bastard apeing of the dress and manners of their betters, on the part of the people, which exists in England. They are not prevented from doing so, if they thought proper: there are no sumptuary laws in France or in Switzerland, but they have other and more attainable models set before them; and a labouring hind is very well pleased if he may pass himself off for the son of a wealthy *bauer*, and would not think it necessary to imitate a prince.

But a more important consideration is, that, in entering this class, he does not undertake a task to which his capital is inadequate, and no loss is occasioned by the imperfect cultivation of the soil. Even if he should have nothing but his industry, after the purchase is made, he has sufficient for the occasion if the allotment be small; and the amount of the purchase money is a known sum, which is rarely the case with the capital which is required for stocking and improving a farm. As regards the former, no deception can exist; as regards the latter, he is continually in danger of deluding himself by a false calculation. Even in the case of his not being able to take possession free of debt, in the first instance, the experience of other countries shows us that, by the aid of the industry and economy which he practises, the debts of the peasant proprietors are usually paid in a very few years. "The magic of property," says Arthur Young, more truly than consistently, "turns sand to gold;" and the smallest possession, if he may but call it his own, if he may think of it as won for him and for his heirs for ever, becomes to him a mine of inexhaustible wealth. His zeal is not slackened by the reflection, which continually weighs

upon the farmer, that the fruits of much of his industry, and many of his improvements, must be reaped by others, when "the place which once knew him shall know him no more." Every time that he plunges his spade into the soil, he thinks that that soil is to be tilled, and its fruits are to be reaped, by those who shall bear his name, and cherish his memory to the latest posterity; and the thought fills him with the strength and the energy of the immortals. He may be the victim of delusion, and very possibly he is so; but, in any view of the matter, it is a delusion of which both he and the community reap the benefit in the mean time. The delusion, supposing it to be such, is a proper and legitimate means of augmenting the national prosperity; and any legislature which does not turn to a profitable account this passion for property in the mass of the people, is guilty of squandering a portion of the national wealth.

But then, in answer to all this, comes the great bugbear of unlimited *morcellement*—and we are told that this desire of property, if left to its natural operation, will bring about a condition of things in which the landed property of the country would be so minutely divided, that the produce would be barely sufficient for the consumption of the cultivators; that there would be no towns, no manufactures, no artisans, and, to use the magnificent anticlimax of the eloquent Mr Cuffey, "no bloody nothing," but a rural and agricultural population, plunged, as it assuredly would be in the circumstances supposed, in destitution and barbarism. Now, on this subject, we must really entreat our readers to peruse for themselves the excellent historical sketch of Mr Thornton. It is too long for insertion in our pages, though, from the exceeding interest of the subject itself, and from the skill with which it is there treated, we venture to say that it will not prove so in the hands of the reader. All that we can here do is to mention, that, after tracing the effects of laws which encouraged the subdivision of property, upon every people by whom they have been adopted, from the ancient Jews to the modern French, he arrives at the [illegible]nclusion—and that, in so far as we can see, without straining the [illegible]cts in any degree—that the continual tendency has been, not to *subdivision* [illegible] *consolidation*; and that, wherever the former prin[illegible]ple has [illegible] pauperism has been the imme[illegible]iate and u[illegible] assertion of the Psalmist, [illegible]hat he ha[illegible] [illegible]ghteous forsaken, nor his seed [illegible]egging bre[illegible] [illegible]y fulfilled wherever the division of [illegible]roperty which [illegible]xisted [illegible] his dominions has not been departed [illegible]rom [illegible] and Mr Thornton [illegible]emarks, that "the bailiff of Guernsey, [illegible] the present da[illegible] [illegible]is observations to the natives of his [illegible] island, mig[illegible] [illegible] truth, use the same, and even [illegible] language [illegible] [illegible]here is not a beggar within the [illegible]imit[illegible] [illegible] [illegible]able-bodied person very rarely, if

ever, seeks admittance into either of the two hospitals or asylums for the poor."*

The case of Rome is too well known to the scholar to need enforcement, and we have already alluded to the despairing exclamation of Pliny, that "large estates had ruined Italy;" nor can those who are acquainted with the pages of Juvenal, of Tacitus, or of any of the later Roman writers, require to be told of the extent to which begging prevailed in the metropolis after the consolidation of estates. The people, who had then become the *poor*, were supported as the poor are amongst us, at the public expense; and they sank from one stage of debasement to another, till at last they became unworthy to exist any longer as a people, and the downfall of the empire was the consequence.

We must make room for one short extract, with reference to England in the middle ages:—

England was never, strictly speaking, a country of peasant proprietors, but always possessed among her inhabitants a considerable extent of extensive landowners. Interspersed with large estates, there were, however, throughout the middle ages, a far greater number of cottage farms held on various conditions. Some were the freeholds of their cultivators; others, though scarcely less the property of the tenant, were held by a servile tenure; some again were leasehold, and some held at will by labourers, who had obtained them in payment of their services, and in lieu of wages. So general was the tenancy of land by the English peasantry previously to the accession of the first Tudor monarch, that the converse of Goldsmith's well-known distich might then have been not inapplicable. Although every rood of ground did not maintain its man, there were few parties who were not either owners or tenants, not merely of a rood, but of several acres. Of the adequacy of these possessions to supply their occupants with abundance of the necessaries of life, we have the most satisfactory proof; and for the hundred and fifty years ending with the fifteenth century, the chain of testimony is particularly complete. Fortescue, Lord Chief-Justice to Henry VI., dilates with contagious exultation on the plenty enjoyed by the lowest class of his countrymen. "They drink no water," he says, "unless it be so that some for devotion, and upon a zeal of penance, do abstain from other drink; and eat plentifully of all kinds of flesh and fish. They wear fine woollen cloth in all their apparel; they have also abundance of bed coverings in their houses, and of all other woollen stuff. They have great store of all hustlements and implements of household. They are plentifully furnished with all instruments of husbandry, and all other things that are requisite to the accomplishment of a quiet and wealthy life, according to their estates and degrees." Fortescue was an avowed panegyrist, and his statements might require considerable abatement if they stood alone; but their perfect accuracy is placed beyond dispute by the most unimaginative and matter-of-fact of all compilations—the statutes at large. Repeated enactments, passed during the period we are examining, use language quite as strong, and still more precise and circumstantial, than that of the patriotic Chief-Justice. In addition to laws designed to keep down the wages of agricultural labour, others were directed against the luxury of the peasantry.

If the reader wishes for confirmation of these remarks, we recommend him to revive his acquaintance with the lusty pilgrims to

* We can confirm the remark from our own experience, both with regard to the Channel Islands, and to many parts of Switzerland and Germany where the system prevails.

Canterbury, among whom there were no beggars, so far as we recollect.

But the consolidation of farms commenced, and we have no more sumptuary laws or enactments to keep down the price of labour. Since the famous statute of 1601, (14 Eliz. c. 5,) in which the necessity of providing employment for the able-bodied poor, by means of parochial assessments, was formally recognised, we have been weighed down by a constantly increasing burden, till we are now taxed to the tune of six millions sterling for permanent poor-rates, to say nothing of occasional, and probably, unless a change of system be adopted, now permanent Irish starvation also.

The historical researches of the French peer (that was) have led to the same results with those of Mr Thornton:—

"The republics of Italy," he says, "in the times of their greatest splendour, the greater part of the provinces of Holland, and the cantons of Switzerland, have been ruled by the law of equal division; and in none of these states was there ever witnessed the smallest portion of the evils which are asserted to be inseparable from such an ordeal." But it is as regards France that his information is most important, for there the experiment has been tried in our own day; and he is an authority on the subject:—

Observe, then, what have been, since 1815, the increasing ciphers of landed proprietors and the population:—

Years.	Number of Properties as Taxed.	Population.
1815	10,083,751	29,152,743
1826	10,296,693	31,851,545
1835	10,893,528	33,329,573
1842	11,511,841	34,376,722

These ciphers show an increase of 14 per cent in the number of properties during the twenty-seven years that separate 1815 from 1842. This is a yearly addition of scarcely more than one-half per cent—an addition that would be unworthy of notice in case the population had on its side received no augmentation. But the case is otherwise—the population during the same period has increased about 18 per cent; and it follows that, instead of having multiplied beyond measure, the number of proprietors has not even followed the general movement of the population, and was, relatively to the total mass of inhabitants in France, a little less in 1842 than it was in 1815.

Another test is afforded us by the cadastre, or state valuation of property, which, previous to the recent changes, had been recommenced in a part of the cantons in which it had been made in 1809 and 1810. We omit the table, and give the result:—

Now, what do these changes amount to? First, 37 cantons, in which the cadastral operations have been completed, contain at the present time 163,277 proprietors. Of these there were in 1810, 154,216, being a numerical increase of 5·7 per cent. As the total mass of inhabitants increased nearly 19 per cent, it follows that, instead of multiplying immediately, the class of proprietors has been relatively a little diminished, and forms at the present time, the smallest part of the total population.

Moreover, though there are at present, in the cantons placed in the first table, 120,000 souls more than there were in 1809 and 1810; and the augmentation of the popula-

tion, necessitating the erection of at least 22,000 houses, has certainly led to the creation of several thousands of new proprietors, strictly territorial, land is not now divided amongst a greater number of owners than it was thirty-two years ago.

These facts seem pretty conclusively to prove that no such infinite subdivision is to be apprehended, even from such a state of the law as that which for so long a time has now existed in France; and though we are by no means ready to advocate its adoption in England, as it exists there, we cannot but regard them as very strong arguments in favour of the adoption of some *less radical* measure for the introduction of peasant proprietors among ourselves.

"But what says your friend Mr Thornton to Ireland?" our readers will ask us—Ireland and her miseries, which gather like a vast moral abscess, till, every quarter of a century, they require to be let out by the bayonet, whilst the patient in the interval must be supported, in pauper fashion, by the bounty of her neighbours. Ireland is indeed the crusher of theories: theories of coercion, theories of conciliation, theories of feeding, and theories of starving—Protestant theories and Catholic theories, are alike shipwrecked upon her inhospitable shore. Against all progression, and all improvement, she seems resolutely and for ever to have set her face. She will neither go, nor drive, nor lead by the foot—thus exceeding in perversity even that most perverse of animals, from a continual observation of whose habits she might otherwise be presumed to have borrowed the rule of her own conduct.

Even if the experience of Ireland had been adverse to peasant proprietorship, we should have held it as no very satisfactory proof of the inapplicability of the system to other lands. But is it so? On the contrary, "Ireland," says Mr Thornton, "is one of the few countries in which there neither are, nor ever were, peasant properties. From the earliest appropriation of the soil, down to the present day, estates have always been of considerable size; and though these estates are now cut up into small holdings, the actual occupiers of the soil, far from being *landowners*, are not even *leaseholders*, but are *rack-rented tenants at will.*"

Here, then, is a very satisfactory answer to any objections which might be made to peasant proprietorship, on the ground of its having been tried, and having failed, in Ireland. The only approximation to the system is in the "tenant right" of the north; and in Ulster, where it prevails, the condition of the peasantry has always been in some degree better than that of their neighbours. The only exception to this comparative prosperity seems to be in the county of Donegal, in which the indigenous Celtic population still exists, and into which tenant right has consequently been only partially introduced, and that in a very imperfect shape.

Nor is this all. Mr Thornton proceeds to show, from histo-

rical records, that the institution of small farms in Ireland is of so recent a date as to render it impossible that they can have *caused* the misery, along side of which they no doubt exist.

From the earliest times, until late in the last century, Ireland was almost entirely a grazing country; and it was from the change which, from a variety of causes, then took place, and the inability of the farmers to remunerate the increased number of labourers, which their newly-adopted system of tillage required, in any other way than by assigning them pieces of ground to build cabins upon, and to cultivate for their own subsistence, that the multitude of peasant farmers now in Ireland sprung up. The *misery* of the Irish, however, is an affair of much older standing. Spencer speaks of the farm-houses in his time, as "rather swine-styes than houses," and of the farmer's "beastly manner of life, and savage condition, lying and living together with his beasts in one house, in one room, in one bed—that is, clean straw, or rather a foul dunghill."

Back, indeed, to the days of that traditionary, and perhaps fabulous, greatness and grandeur, which their historian so eagerly records, wretchedness seems to have been the inalienable birthright of the Irish people; and, with such a story before us, we confess that we are not of the number of those who can look forward with very sanguine hope to the future which awaits them. We would fain join with Mr Thornton, if we could, in throwing overboard the theory of "the incorrigible laziness of the Celtic race;" but when, for hundreds of years, in the midst of a rich and fruitful land, with the spectacle of industry and civilisation continually before their eyes, we see a people resolutely clinging to a barbarian idleness, and preferring it, even when accompanied by every possible privation and every possible indignity, to an independent and honourable plenty, when coupled with exertion, we are tempted to seek for some deeper cause than mere external circumstances for so deplorable a phenomenon. Our opinion will be further confirmed if we should discover that, even in circumstances altogether dissimilar, the same peculiarities of character have manifested themselves—nay, that, under every external change whatsoever, these characteristics have remained invariable. If in Scotland, in England, and in France, wherever we have had this people in its purity, we have seen the same aversion to all the appliances of civilised life, we shall probably have little confidence in any proposal for the amelioration of their condition in Ireland, which does not involve some change affecting the very blood of the people themselves. Measures which should bring about an extensive crossing of the Celts with other races would, in our opinion, be the only ones from which permanent benefit might with confidence be expected.

It sounds, no doubt, very humane and very enlightened for Mr Mill, in his recently published Political Economy, to tell us that "of all vulgar modes of escaping from the consideration of the effect of social and moral influences on the human mind, the most vulgar is that of attributing the diversities of conduct and character to

inherent natural differences." The question of how the Irish alone, of all the populations of Europe, arrived at the condition of abject wretchedness in which we find them, remains unanswered by him, and is perhaps unanswerable on any other hypothesis than the dreary one which we have suggested. If another solution can be found, we shall rejoice in its discovery; and in the mean time, at all events, it is both our duty and our interest to remove every obstacle which can be shown to impede their improvement. They are children of the family, not hirelings; we are bound to them for ever, and we must make the best of them. But if they sunk to the bottom, whilst their chances for swimming were, for any thing which we can see to the contrary, the same with those of the other European populations, it is not very probable that they will rise by their unaided efforts to the surface, with the accumulation of impediments which covers them now; and if the greatest of these hindrances be the *cottier* system, then let the cottier system by all means be cleared away.

We are delighted to find that a question so intensely and so painfully important at the present hour, as that of the tenure of land in Ireland, has at length been grappled with by a writer so able and so earnest as Mr Stuart Mill; and we feel confident that some measure, partaking of a better character than a mere "hand to mouth" expediency, will be the result of his valuable labours. In the former part of this paper, which has had reference to the comparative advantages and disadvantages of the peasant proprietary system in general, we have preferred the disquisitions of Mr Thornton and M. Passy to those of Mr Mill, because they possessed the claim of priority of publication, and seemed on the whole to contain the argument quite as fully and as clearly as his. In the latter work, however, the discussion finds its place as a component part of a complete system of political economy; and in this point of view we earnestly recommend it to the attention of our readers, although it was not our object so to consider it here. As regards the application of the principles evolved in the general discussion, to the present condition of the Irish, there is much coincidence between the views of Mr Thornton and those of Mr Mill, which the latter has not failed to acknowledge. His observations, however, on this branch of the subject, seem to us to carry with them a completeness of conviction which does not arise from the perusal of those of Mr Thornton; and although we had at first determined to defer the consideration of the application of peasant proprietorship to Ireland to a future opportunity, we conceive that it would be nothing short of a dereliction of duty if we did not endeavour to make room for some of them at present.

The question, What system of agriculture is best in itself? is, for Ireland, of purely theoretical interest: *the people are there,* and the problem is, not how to improve the country, but how it can be improved by and for its present inhabitants. It is not probable that England will undertake a simultaneous removal of two millions—the

smallest number which, in the opinion of any person acquainted with the subject, would make a clear field for the introduction of English agriculture. But unless she does, the soil of Ireland must continue to employ and feed the people of Ireland: and since it cannot do this on the English system, or on any system whatever of large farming, all idea of that species of agricultural improvement as an exclusive thing must be abandoned: the *petite culture*, in some one of its shapes, will continue; and a large proportion of the peasants, if they do not become small proprietors, will remain small farmers.

This seems to us rather an unanswerable argument against the introduction of a system which, in proportion as it improves, employs fewer and fewer labourers. *The people are there*, and they are there, moreover, with habits the least industrious of any people which perhaps ever existed on the face of the earth. If then it be true, as the great apostle of large farms, Arthur Young himself, has asserted, that the feeling of property is an *omnipotent principle*, to them above all it is desirable that this principle be at once applied. Hear Mr Mill.

A perpetuity is a preferable tenure to a long lease—it is a far stronger stimulus to improvement: not only because the longest lease, before coming to an end, passes through all the varieties of short leases down to no lease at all, but for more fundamental reasons. It is very shallow, even in pure economies, to take no account of the influence of imagination: there is a virtue in "for ever" beyond the longest term of years: even if the term is long enough to include children, and all whom a person individually cares for, he will not exert himself with the same ardour to increase the value of an estate his interest in which diminishes in value every year. A lease, therefore, is never a complete substitute for a perpetuity.

Mr Mill, of course, freely admits the advantages which would arise from the introduction of long leases, and rents fixed on some principle other than that of the wretched competition which at present obtains, and where a sum, three or four times the value of that which, even by the best system of agriculture, could be obtained from the land, is constantly *promised*; whereas the agreement comes practically to be, that the landlord shall just have what may be over, after the tenant and his family have been kept from starving. That the cottier system, holding out, as it does, not the shadow of an inducement to any exertion beyond what is requisite for warding off immediate starvation, is the very worst which can possibly be conceived, is admitted on all hands: but when we abandon the very worst, it is not necessary that we should adopt the next worst. The evil is great enough to call, not for the weakest, but the strongest remedy which our political medicine-chest can furnish forth; and if that remedy be the "omnipotent principle" of property, then to it, in common prudence, we must resort.

But is it practicable? can it be? We shall lay the proposal before our readers, and they shall judge for themselves. We enter not at present into any discussion with Mr Mill upon what would or would not be an infringement of property. The *ultima ratio* of the State resuming into its hands the property of individuals, even with a compensation which *it* might consider sufficient, is rather too start-

ling to English ears, to admit of its being brought forward with any effect on an occasion of immediate urgency. If admitted at all, it could be only by becoming familiar through the intervention of many a debate and many a leader. But is there nothing which we can do until we have reconsidered the whole groundwork of our previous economy? Mr Mill thinks that there is.

There are then strong objections, as well as great difficulties, opposed to the attempt to make peasant properties universal. But, fortunately, that they should be universal is not necessary to their usefulness. There is no need to extend them to all the population, or all the land. It is enough if there be land available, on which to locate so great a portion of the population, that the remaining area of the country shall not be required to maintain greater numbers than are compatible with large farming and hired labour. For this purpose, there is an obvious resource in the waste lands, which are happily so extensive, and a large proportion of them so improvable as to afford a means by which, without making the present tenants proprietors, nearly the whole surplus population might be converted into peasant proprietors elsewhere.

The plan is no novelty to the reading public, though it seems, like most other proposals of a similar nature, to be long in finding its way into the precincts of St Stephen's. Mr Mill claims no originality, and ascribes to Mr Thornton the merit of first bringing it prominently forward, in his work on "Over-population and its Remedy." We quote the following in proof of its practicability:—

The detailed estimate of an irrefragable authority, Mr Griffith, annexed to the report of Lord Devon's Commission, shows nearly a million and a half of acres reclaimable for the spade or plough, some of them with the promise of great fertility, and about two millions and a half more, reclaimable for pasture; the greater part being in most convenient proximity to the principal masses of destitute population. Besides these four millions of acres, there are above two millions and a half, pronounced by Mr Griffith to be unimproveable: but he is only speaking of reclamation for profit; it is doubtful if there be any land in a temperate climate which cannot be reclaimed and rendered productive by labourers themselves, under the inducement of permanent property. Confining ourselves to the one and a half million of arable first mentioned, it would furnish properties averaging five acres each to three hundred thousand persons, which at the rate of five persons to a family—a rather low estimate for Ireland—answers to a population of fifteen hundred thousand. Suppose such a number drafted off to a state of independence and comfort, together with a very moderate additional relief from emigration, and the introduction of English capital and farming, over the remaining surface of Ireland, would at once cease to be chimerical.

But then, as to the capital required for the fulfilment of such a scheme—for, after all that has been squandered upon Ireland, our people are naturally disposed to fight shy of another Irish loan, with the Greek Kalends for a term of payment—on this subject Mr Mill quotes Mr Thornton, and we shall follow his example.

The improvement of waste lands, says Mr Thornton, may perhaps be thought to require a good deal of capital; but capital is principally useful for its command of labour, and the Irish peasantry have quite labour enough at their disposal. Their misfortune is, that they have so much: their labour would not be the worse applied, because they worked for themselves, instead of for a paymaster. So far is large capital from being indispensable for the cultivation of barren tracts, that schemes of this kind, which could only bring loss to a rich speculator, are successfully achieved by his penniless rival. A capitalist must have a certain return for the money he lays out; but the poor man expends nothing but his own superabundant labour;

which would be valueless if not so employed, so that his returns, however small, are all clear profit. No man in his senses would ever have thought of wasting money upon the original sand of the Pays de Waes; but the hard-working boors, who settled there two hundred years ago, without any other stock than their industry, contrived to enrich both themselves and the land, and indeed to make the latter the richest in Europe. There is no soil so worthless that an English labourer will not eagerly accept an allotment of it; and while the green valley, from which some Highland community has been driven, is fast relapsing, under the superintendence of a wealthy sheep farmer, into its primitive wildness, its former tenants are forming new patches of arable land on the rock-strewn moor along the sea coast.

"The profit of reclaiming waste land," says the digest of Evidence on Lord Devon's Commission, "will be best understood from a practice not uncommon in Ireland, to which farmers sometimes resort. This consists in giving the use of a small portion of it to the poor cottier or herdsman for the first three crops, after which this improved portion is given up to the farmer, and a fresh piece of waste land is taken on the same terms by the cottier. Well," adds Mr Mill, "may the compiler say, here we have the example of the very poorest class in Ireland obtaining a livelihood by the cultivation of waste land under the most discouraging and the least remunerative circumstances that can well be imagined."

That some outlay in the first instance would be requisite, is of course implied in the proposal of any scheme of relief whatsoever, and the present professes to be no exception to the rule. But if we consider what we are yearly, and *hourly*, expending upon Ireland at the present time, without even the prospect of permanent benefit, or of ultimate diminution of that expenditure, we have no difficulty in stating it as our opinion, that a scheme of this nature would, in the course of a very few years, prove a source of very great saving to this country.

On the manner in which the return ought to be made, Mr Mill has some very judicious observations:—

It would be desirable, and in most cases necessary, that the tracts of land should be prepared for the labours of the peasant, by being drained and intersected with roads at the expense of government; the interest of the sums so expended, and of the compensation paid for existing rights to the waste land, being charged on it, when reclaimed, as a perpetual quit-rent, redeemable at a moderate number of years' purchase. The state would thus incur no loss, (?) while the advances thus made would give that immediate employment to the surplus population of Ireland, which, if not given in this manner, will assuredly have to be given in some other, not only less useful, but far less likely to repay its cost. The millions lavished during the famine, in the almost nominal execution of useless works, without any result but that of keeping the people alive, would, if employed in a great operation on the waste lands, have been quite as effectual for relieving immediate distress, and would have laid the foundation, broad and deep, for something really deserving the name of social improvement. But, as usual, it was thought better to throw away money and exertion in a beaten track, than to take the responsibility of the most advantageous investment of them in an untrodden one.

But if the government positively will do nothing from which ultimate good can by possibility arise, there is yet another means—less effectual, no doubt, and less immediate in its operation—which remains, in private speculation; and in this the Chartists, of all people

in the world, have undertaken to show us the example in their colony, now in full operation near Rickmansworth in Hertfordshire. As the hint which it furnishes is perhaps the only valuable thing for which we have to thank this body of politicians, we may as well turn it to what account it will yield. The plan is as follows:—

Funds were raised, in shares, by a joint-stock company. With part of these funds an estate of several hundred acres was bought. This estate was divided into portions of two, three, and four acres, on each of which a house was erected by the Association. These holdings were let to select labourers, to whom also such sums were advanced as were thought to amount to a sufficient capital for spade labour. An annual payment, affording to the company interest of five per cent on their outlay, was laid on the several holdings as a fixed quit-rent, never, in any circumstances, to be raised. The tenants were thus proprietors from the first; and their redemption of the quit-rent, by saving from the produce of their labour, is desired and calculated upon.

Irish landlords, too, might do much; and instead of no profit at all, which under the present poor-law is the lot of many of them, might in time obtain something like the real value of the lands which they possess. But for any comprehensive measure, which would effectually grapple with *the misery*—the great national characteristic of the Irish as they are—we fear we must wait, long though it may be, for some government which is willing to do and to risk something.

That the immediate outlay would be greater than Mr Mill has calculated, we believe; for there are several necessary operations, such as the erection of huts upon the portions of ground to be reclaimed, which he has left altogether out of account. Still the scheme is surely preferable to the present system of shortsighted, and grovelling, and expensive expediency: it at least *promises* something like permanent good—it holds out a chance of winning, which is something in a game which we cannot abandon; and although, for the reasons which we have already stated, we are far from sanguine of the results of any treatment, which has the Irish for its subjects, we would gladly see the experiment tried, both for their sakes and our own.*

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* There is no lack of minds, even in Ireland, open to the importance of the views which we have stated. Since the above was written, we have seen, in the *Irish Agricultural Journal*, a very sensible paper by Sir Robert Kane on "The Large or Small Farm Question, considered in regard to the present circumstances of Ireland;" and although no novelty attaches to the matter which it contains, we notice it simply in proof of the coincidence between the views of its author and those of the writers to whom we have before referred. May we hope that where so many *think* together, some one will at last be found to *act*, and that the *idem velle atque nolle* which seems to bind them together may indeed prove a bond of union for good.

THE USE OF LIME IN AGRICULTURE.

No. IV.

By Professor Johnston.

Section I.—*When ought Lime to be applied to the land?*

This question may refer to the period either of the year or of the rotation at which the lime ought to be applied.

1°. *The period of the year* at which *quick*-lime is usually applied, depends very much upon two considerations of an economical kind.

a. Upon the leisure which the farmer possesses from the other operations of the farm. He does first that which is indispensable. His ploughing, and sowing, and reaping, cannot be delayed. He sends his teams to the lime-kiln only when they are at liberty from other operations. Thus the winter months, and those of spring after the corn is sown, are the periods during which, with his own horses, he can most conveniently bring lime to his farm. By some it is then applied as soon as it is slaked, while others lay it up in heaps, and leave it for a time carefully covered with sods. By protecting it from the weather, the application may thus be delayed for two or three months, without materially affecting the usefulness of the lime to the soil.

b. Upon the period of the year when lime can readily be obtained. In some districts the demand for lime at particular seasons is so great, that the lime-burners within a reasonable distance cannot prepare a sufficient supply. This necessarily retards the operations upon some farms, and causes an alteration in the period when it is most economical to apply it.

In other districts, again, where sea-borne lime is principally employed—the north-east and south-west coasts of Scotland for example—the summer months, being the most favourable for transporting the lime by sea, are those also in which the farmer can most readily obtain it. Thus the leisure of his teams is less consulted than the convenience of the sea traffic; and the application of *quick*-lime is necessarily made either late in spring, when preparing the land for the turnip and potato crop—or in summer, when in some districts it is dusted over the potato and other root crops before hoeing or ridging them up—or late in the autumn, when it is spread over the stubble and ploughed in, or over the lea, preparatory to its being brought again into arable culture.

These circumstances, of course, though they affect the time of bringing the lime to the farm, do not affect the season of applying it, when it is to be laid on in the compost form. This

compost can be made at any season, can remain for any length of time, and can be applied whenever the farmer, from having leisure or for other reasons, considers it most expedient.

2°. But *the period of the rotation* at which the lime ought to be applied, is of much more consequence, inasmuch as, that being settled, the season of the year at which it will be most proper to lay it on will also be in a great measure determined.

Now the nature and condition of the land determines the kind of cropping, this, again, the kind of rotation which on the whole will be the most profitable, and the kind of rotation the period at which the lime ought to be applied.

Thus on heavy soils, where a naked fallow forms part of the rotation, as on the Oxford or Gloucester clays, where wheat, beans, fallow, is the course of cropping,—or, as in some parts of Worcester, where the more scourging course of wheat, beans, wheat, fallow prevails, the most natural time for applying the lime is upon the naked fallow.

Again, in an improved rotation upon these heavy soils, where, in consequence of partial draining—as by thorn drains—the naked fallow is resorted to only once in six or seven years, and yet turnips are but little grown, the practice of liming the fallow is not so universally approved. It is applied before the barley to help the seeds, or in the autumn or spring to help the beans, or clover, or tares, almost as often as to the naked fallow. There is, indeed, no rule or principle, I believe, by which the pecuniary benefit of applying it at the one time rather than the other, can be shown to be distinctly greater.

But where the alternate husbandry prevails—to the exclusion, more or less entirely, of naked fallows—there are one or two facts which serve as good guides to the practical man, and influence him much in applying his lime. Thus—

a. Lime is found to produce little apparent benefit, upon the first, in some cases even upon the second corn crop after it is applied—there is less inducement, therefore, to lay it on the land immediately before such a crop is to be grown.

b. But the first green or root crop, which follows the application of lime, is almost always benefited by it. Turnips, clover, tares, and potatoes show an immediate improvement; and hence the practical man is most frequently induced to apply it when preparing his land for these crops. This determines also, in some measure, the season of the year at which it should be laid on. In the case of turnips or potatoes it does not do so absolutely, since some prefer laying it on in the autumn upon the stubble, and ploughing it in with a light furrow — while others incorporate it with the soil in early summer, when ploughing and harrowing and ridging up the land—and some even scatter it over the surface when the turnips and potatoes are already

considerably advanced, and are ready for earthing up. In *most cases*, where the lime can be seasonably obtained, I would prefer to harrow it in early in the spring or summer, as likely to keep it nearer the surface of the land, while at the same time it would have been sufficiently intermixed with the soil to prevent its having any injurious effect upon the manure to be afterwards applied. In the case of potatoes, however, it is considered the best practice by the skilful potato growers of Renfrewshire, to strew it over the land when the crop is already some way above the ground, and to mix it with the soil in the hoeing. To this practice there is no objection,—it keeps the lime near the surface, and prevents it from coming in contact with the manure. Where lime is to be applied for the cure of fingers and toes, experience indicates the autumn as the most successful time for applying it.

Lastly, where land is to be reclaimed or broken up, from old, sour, matted grass, or from heath, the lime should be applied one or two years before the plough is put into it. By this means the coarse grasses and heaths are destroyed, their roots die and lose their tenacity, and thus to plough it up is a lighter labour, while the land also crumbles and mellows with less working, and the sod disappears in a much shorter period of time. The application of lime for this purpose may be made at any season of the year when the other labours of the farm leave leisure for the purpose. If the grass to be broken up be of value to the farmer, he will of course, in so far as he can, allow that season to pass over during which its worth for the pasturing of cattle is considered the greatest.

On this point I add only one other observation. *Quick*-lime has the effect of disengaging and setting free the ammonia from guano and from fermenting manures. It is a prudent, therefore, and a safer practice to apply the lime some short time before or after such manures have been laid upon the land. Where the soil is moist, and abounds in vegetable matter, there may not be much loss should the lime and other manures come in contact beneath its surface; but in dry soils, and on the surface of the land, the admixture of the two ought to be carefully avoided. After the lime has been some time in or on the surface of the soil, and has become converted into carbonate, it can exercise no injurious effect upon any kind of manure.

Section II.—*Ought Lime to be applied in large doses at distant intervals, or in small doses frequently repeated?*

This also is an important practical question, in regard to which working farmers differ much in opinion, though it is one upon which, in the abstract, it is not difficult to decide. Thus:—

1°. A certain proportion of lime is indispensable in our climate to the production of the greatest possible fertility. Let us suppose a soil to be wholly destitute of lime, the first step of the improver would be to add to it this indispensable proportion. This would necessarily be a large quantity, and, therefore, *to land limed for the first time, theory indicates the propriety of adding a large dose.*

2°. The full effects of this large dose are not experienced for several years. After the lapse of five or six years, during which it has been gradually mixing with the soil, its beneficial effects become the most striking. *For six or eight years, therefore, after a heavy liming, no further addition of lime requires to be made.*

3°. But after this period the productiveness of the land, if the treament continue the same, gradually diminishes, the effect of the lime wears off, and by degrees, if no more be added, the land will return to a condition very nearly the same as that in which it lay before the lime was added. This arises from the circumstance that the lime is gradually removed from the land by the agency of natural causes. *To keep land in the most productive condition, therefore, as much lime ought to be added from time to time as will supply this natural waste.*

4°. We have seen, in a previous article, that the quantity which long practice in various districts seems to sanction, as necessary to supply this natural waste, is from 8 to 10 bushels a-year. After land which has been once heavily limed, therefore, has reached its most productive condition, *it ought to be supplied at shorter intervals with smaller doses, at the rate of about 8 bushels a-year, in order to maintain its productiveness at the highest point.*

The reader will understand that this repetition of lime is to be recommended only where the land is otherwise well farmed and manured, and where the object is, not to take as much as possible out of the land in a given time, but *to retain the land permanently in the most productive condition.*

SECTION III.—*Comparative profit of the method of frequent Liming.*

The superior profit of this latter method of frequent liming is easily illustrated.

Let us suppose that to each of two separate acres of the same clay land, 200 bushels of lime have been applied at the same time. The whole will have been fully mixed with the soil, and will have begun to produce its greatest effect by the end of four or five years. Suppose the crops now to equal 30 bushels of wheat an acre, or the equivalent of this quantity in other crops,—and let the one be cropped for 20 years in succession, without any further liming, while the other receives a small dose of 40 or 50 bushels of lime

at the end of every four or five years. The latter acre will be kept up, by these successive additions, to its maximum state of productiveness of 30 bushels of wheat; the former will by degrees become less productive, and will gradually revert to its original condition.

Suppose no diminution in the crops to become sensible before the end of the first ten years—which will rarely happen—but that, during the next ten, the diminution becomes constantly greater, till, at the end of the twentieth year, the produce is reduced to 20 bushels a-year, on that acre to which no new dose of lime has been applied. This will be equal to an average produce of 25 bushels an acre during the latter ten years, or 250 bushels in the whole.

But the other acre, which is regularly limed, has yielded every year at the rate of 30 bushels, or 300 bushels in these ten years. The account between the two acres, therefore, for this second period of ten years, stands thus—

10 crops of 30 bushels amount to	300 bushels;
10 crops of 25 bushels amount to	250 bushels;
Being a difference of . .	50 bushels

in favour of the frequently limed field; or *nearly two entire crops every lease of twenty years.*

This calculation is made on the supposition that the full effect of the first dose of lime continues for ten years, which experience says is very seldom the case. The result above shown is, therefore, even more favourable than it ought to be to the large-and-seldom-dose system. I might consequently have estimated the probable profit of frequent doses still higher, but as I am only anxious to lead the practical man to the adoption of that method which will put most money into his pocket, I leave the above moderate estimate of its economical value to his candid consideration.

SECTION IV.—*Influence of Tenure on the mode of Liming.*

But the kind of tenure on which a farm is held materially influences the mode in which the tenant considers himself justified in applying lime to his land.

1°. When the land is held on a lease of 19 or 21 years, and when within 10 years of the end of his lease, the tenant can make arrangements to have his lease renewed at a fair rent; he is then in the best possible circumstances for treating the land well, because it will be most profitable to himself as well as to the landlord. He may then lime largely at first, and may at frequent intervals add smaller doses, so as to maintain the land continually in the highest state of productiveness. But

2°. If the tenant holds by a 19 years' lease, and has no certainty of continuing, or no desire to continue, after the expiry of that term, he may lime largely during the first rotation; but during the

last two rotations, his interest is to get as much out of the land as he can before he leaves it, and therefore he adds nothing which he can possibly avoid.

In leases of this kind the tenant only limes once, as is much the case in Roxburgh and some of the adjoining counties; or he limes twice in his lease of 21 years, as is occasionally done in Renfrewshire, West Lothian, and York, Durham, and other English counties in which land is held on lease; or he limes once in 6 or 8 years, as is frequent in Ayrshire, the Carse of Stirling, and parts of Wales. By this means the full or main virtue of the lime has been exhausted for his benefit before his tenure of the land has expired.

3°. In many leases and agreements the condition is still expressed, that the tenant shall either lime or manure every 6 or 8 years; in others, he is bound both to lime and manure within a stated number of years. In such cases as these, the tenant has no choice, and the tenure by which he holds alone determines the important question, of how much, as well as how often, lime is to be applied to his land.

4°. Where there are no leases, therefore, it would appear at first sight as if circumstances would be more favourable to the exercise of that skilful discrimination and choice in regard to the mode of liming, by which the instructed farmer will be enabled to benefit in the highest degree the land he cultivates.

But this is by no means the case. Other cross circumstances here come in which disturb the mind of the tenant as to the economy or propriety of this, as well as of many other modes of improvement. His tenure is certain for one year only. The lime he applies will produce its full effect only after several years. Should any circumstance arise, therefore, to deprive him of his farm—should he himself die, or his landlord, or the steward—his family would in most cases lose the money he had invested in lime with a view to after profit, and had buried in his land. There is no doubt that this consideration influences the conduct of the yearly tenant, not only in reference to the application of lime, but in reference also to other operations he might profitably undertake. It operates often unconsciously, and becomes, after a generation or two, a kind of general habit or rule of conduct, opposing itself to all unnecessary outlay, and to every thing like speculative trials—which habit, among a body of tenantry, is often to be overcome only by a large infusion of new blood.

The remedy is simple. Let compensation be given to the tenant for all unexhausted improvements, according to a fair and reasonable scale, and this form of hindrance, at least, will no longer exist to the employment of the best modes of farming, even though they should involve a larger outlay of money, and for a longer period of time.

I would not recommend the introduction into this country of the tenant-right of the sister island—the Scotch lease is, I believe,

fairer to all parties; yet, unless the custom of making allowances for liming and other improvements be guaranteed to the retiring tenant, the best management of the land can never be secured.

Though, therefore, both theory and practice concur in showing that the method of frequent liming is most likely to maintain the highest fertility of the land, yet it is evident that the peculiar circumstances in which the farmer is placed must materially affect the course of conduct which it will be most prudent for him to adopt.

One thing, however, I would repeat, must be borne in mind by those who, in adopting the best system of liming, do not wish both to injure their land and to meet with ultimate disappointment. Organic matter, in the form of farm-yard manure, of bone or rape dust, of green crops ploughed in, or of peat and other composts, must be abundantly and systematically added, if at the end of 20 or 40 years the land, in which the full supply of lime is kept up, is to retain its original fertility. High farming is the most profitable, for the soil is ever grateful for skilful treatment; but he who farms high, in the sense of keeping up the supply of lime, must also farm high in the sense of keeping up the supply of organic and other manures in the soil, otherwise present fertility and gain will be followed by future barrenness and loss. If this is not to be done, it were better to add lime at long intervals, since, as the quantity of lime diminishes, the land begins to enjoy a little respite, and has had time in some measure to recover itself—the cropping in both instances being the same—before the new dose is laid upon its surface.*

SECTION V.—*Of the length of time during which Lime acts, and of Compensation for liming.*

The length of time during which lime acts is a question of considerable practical importance in reference,—

1°. To the proper time of applying a renewed application.

2°. To the expense of cultivating the land during a series of years.

3°. To the amount of compensation which ought to be allowed to a way-going tenant for the lime he has added to his land.

The last of these, in cases where disputes arise between landlord

* "In the neighbourhood of Taunton, in Somersetshire, and over all the soil of the new red sandstone, the farmers lime their land every time it comes in course to fallow for turnips, and this produces excellent crops, even without dung."—*Morton on Soils*, 3d edition, p. 181. The practical reader must not consider this custom of the Somersetshire farmers as at all at variance with what is stated in the text; he must conclude, rather, (if the sentence here quoted is meant to imply that they lime their arable land so repeatedly, and yet add no organic manure,) that they will, sooner or later, cease to boast of its fertility.

and tenant, becomes often a question of very considerable importance.

The length of time during which a given dose of lime may be expected to benefit the land depends upon a variety of circumstances—such as the quality of the lime, the physical character of the soil, the quantity of lime it previously contained, the kind of husbandry or course of cropping that is followed, the quantity of rain that falls, the state of the drainage, and other considerations of a similar kind. These can only be ascertained by actual investigation in each locality. The opinion of practical men in the best cultivated districts, therefore, is perhaps the best *general* guide we at present possess.

a. In Lincolnshire, where the tenants not unfrequently have a clause in their leases entitling them to compensation for improvements, it is usual to allow seven years for marl or lime; so that, if the tenant leave his farm only one year after the lime is applied, he is entitled to six-sevenths of the cost of applying it; if two years after, five-sevenths, and so on. In other parts of the same county, ten years are allowed for marl, and seven for lime.* This distinction is probably made because the marl acts more slowly, and, being laid on in larger doses, acts also for a longer time.

At an agricultural meeting held at Loughborough some time ago, an allowance of five years for lime was considered sufficient, and was embodied in a code of resolutions in reference to such points, which was adopted and recommended by the practical farmers of that neighbourhood.

b. In Scotland, I am not aware of any district in which a recognised principle of this kind is known or acted upon. The custom of granting leases, during the currency of which the tenant is to remunerate himself for *every thing* he does to the land, giving it up at the end of the term, free, to the landlord—this custom has obtained such universal prevalence that no idea is entertained, and no provision usually made, for compensation to a way-going tenant when his lease has expired.

A break, however, sometimes occurs in the lease, in the event of which being taken advantage of, compensation is made to the tenant for liming and other improvements. The determination of the amount of such compensation, in the absence of specific clauses, becomes a matter of great difficulty. Where the custom prevails of adding lime only once during the currency of the lease, the tenant naturally believes that he will only have extracted the full benefit of the lime he has added when the end of his lease is come. And forgetting that, during the last half of his lease, the sensible

* *Journal of the Royal Agricultural Society*, vol. v., p. 347.

effect of the lime is constantly diminishing, practical men are inclined to claim and to allow each other a proportion of the cost equal to that which the number of years the lease has to run bears to the whole term of the lease. Thus, if nine of the nineteen years have to run, the tenant is allowed nine-nineteenths of the cost of lime and cartage, and if eight years, eight-nineteenths, and so on. This allowance, as a general rule, is too high.

Where it is customary to lime more frequently, once every six or eight years, for example, a fair allowance is more easily made. Indeed, the custom of the district must be taken into account wherever an allowance is made or claimed for liming; but I doubt much if, in any old cultivated land, more than ten or twelve years should be allowed for such a beneficial action of lime or marl, as to entitle the tenant to a compensation for applying them.

There was much good sense and experience, I think, in the opinion of an old East Lothian farmer whom I lately consulted on the subject. "For *a large dose* of lime," he said, "I would allow—after three years, one-half; after six years, one-third; after eight years, one-fourth, or less." This was on land long cultivated on the four-course system, and probably frequently limed before.

In awarding compensation, however, regard should also be had to the previous condition of the land to which the lime or chalk has been applied. If the land has been limed or chalked for the first time, it is the result of universal experience, either upon the stiff clays of the south or the heathy hills of the north, that a much greater benefit, and for a longer period, is produced than by any subsequent liming of an equal extent. The increased value of the land to the tenant, therefore—his beneficial interest, that is—is greater, and he is entitled to a pecuniary compensation in some degree proportionate. On the other hand, if the experience of the neighbourhood has already proved that liming of a particular kind, or under particular circumstances, does little good, it would be unfair, in the event of his removal, to allow compensation for an outlay which may have been made contrary to the sense and experience of the district—the benefits of which, also, are not distinctly visible. But as no general rule can be laid down which local circumstances will not modify, the safest way in all cases is to provide, in the covenants between landlord and tenant, for such probable claims and contingencies.

c. In some parts of England, where the land is held on a yearly tenancy, the retiring tenant is allowed to make an agreement with his successor—in some cases himself to select a person who will comply with his own conditions, while he is also acceptable to the landlord. Though very like the tenant-right of the north of Ireland, this method has certainly the advantage of keeping the landlord and his tenantry from coming into unpleasant collision.

SECTION VI.—*Effects of Marl, of Shell, Coral, and Limestone Sands, and of Crushed Limestone, upon the Soil.*

Lime is largely applied to the land in the unburned as well as in the burned state. In the former state it exists in marl, in coral, shell, and limestone sands, in crushed limestone, and in chalk. In all these forms it is very extensively and economically employed by the practical farmer.

The effects which result from the application of these natural forms of unburned lime—carbonate of lime—are of two kinds.

1°. Their *physical* effect in altering the natural texture of the soils to which they are added. This effect will necessarily vary with the nature and proportion of the earthy matter associated with the lime. Thus the clay marls, as in Norfolk, will improve, by stiffening light and sandy soils; the shell sands and limestone gravels, by opening and rendering more free and easier worked such soils as are stiff, intractable, and more or less impervious; while either will impart solidity and substance to such as are of a peaty nature, or over-abound with other forms of vegetable matter.

2°. Their *chemical* effect in actually rendering the soil productive of larger crops. This effect is altogether independent of any alteration in the physical properties of the soil, and is nearly the same in *kind*, whatever be the variety of marl, &c. we apply. It differs in *degree*, chiefly according to the proportion of calcareous matter which each variety contains. This action of the pure carbonate of lime they contain is no doubt modified in some cases by the proportion of phosphate of lime, &c. with which it may be mixed; it is also modified by the animal and saline matters which are present in the recent corals and shell sands.

The effects of marl and calcareous sand being dependent upon circumstances so different, it is not surprising that the opinions of practical men should be divided in regard to the action of this or that marl upon their respective soils. The substance applied to the land is seldom exactly alike in any two localities, and hence unlike results must necessarily follow, and disappointment be occasionally experienced from its use. And yet the importance of rightly understanding the kind and degree of effect which these manuring substances ought to produce in different circumstances, may be estimated from the fact, that a larger surface of the cropped land in Europe is improved by the assistance of calcareous marls and sands, than by the aid of both burned lime and of farm-yard manure put together.

It is not easy, in any case, to estimate with precision what portion of the effect caused by a given marl is due to its chemical, and what to its physical action. Even the pure limes, when applied in large doses, produce a change in the texture of the soil, which on stiff lands is beneficial, and on light or sandy fields is often injurious. In all cases, therefore, the action of lime applied in any

form may be considered as partly physical and partly chemical—the extent of the chemical action in general increasing, as I have said, with the proportion of lime which the kind of calcareous matter employed is known to contain.

3°. The *observed* effects of marl and shell sands, in so far as they are chemical, are chiefly the following—

They alter the nature and quality of the grasses when applied to pasture—they cover even the undrained bog with a short rich grass—they extirpate heath, and bent, and useless moss—they exterminate the weeds which infest the unlimed corn fields—they increase the quantity and enable the land to grow a better quality of corn—they frequently destroy or prevent the injurious action of insects upon vegetable growth—they manifest a continued action for many years after hey have been applied—like the purer limes, they act more energetically if aided by the occasional addition of other manure—and like them they finally exhaust* a soil from which successive crops are reaped, without the requisite return of decaying animal or vegetable matter.

SECTION VII.—*Effects of Chalk.*

Of the use of chalk as an improver, I have already treated in a previous article. It is applied more or less extensively over all that part of England where the soils rest upon, or are within reach of, the beds of chalk.

Chalk consists not merely of finely divided particles of carbonate of lime, but like the fresh-water marls, not unfrequently in great part of the skeletons, shells, and other spoils of minute animals—of marine origin in this case, and generally to be detected only by the use of the microscope. Hence chalk usually contains traces of animal matter—particles of silica, the substance of flint, retaining the forms they possessed when attached to the living sponge or infusorial animal of which they formed a part—traces of phosphate of lime, the material of bones, also derived from the bodies of animals—and indefinite quantities of the various saline substances which are dissolved in sea water.

But the proportion of all these substances varies in different beds of chalk and in different localities. The particles of chalk also differ in their degree of fineness, and the proportion of mud or clay with which they are mixed is very fluctuating. All these circumstances must modify very much its agricultural effect, especially in so far as it is of a chemical nature.

Hence the quantity applied to the land varies both with the nature of the land itself and with the quality of the chalk, with the more or less perfect crumbling also which it undergoes by the action of the winter's frost, and with the purpose it is intended to serve.

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* Of shell marl the same quantity exhausts sooner than clay marl, (Kames.) This is owing, probably, to the larger proportion of lime contained in the former.

It produces physical as well as chemical improvements.

1°. It opens and imparts freeness to stiff clays. The first and leading principle on the London clays, and indeed upon all the stiff clays within its reach, is the application of chalk. This, in every instance, on the first application produces an astonishing change upon the soil, enabling it to produce valuable crops for many years afterwards without the assistance of any addition of manure. It is afterwards applied along with other manures to diminish the tenacity of the soil, and thus to render it more porous.

2°. It adds firmness to such as are of a sandy nature, so that blowing sands are consolidated, while naturally sterile sands have in some localities been brought into a state of comparative fertility, by large applications of it.

3°. It gives tenacity and closeness to gravelly soils. Mr Gawler states that a Hampshire gravel thus stiffened, instead of 12 to 16 bushels of wheat, yielded afterwards of 24 to 30 bushels.*

If a physical improvement of this kind is required, it is laid on at the rate of from 400 to 1000 bushels an acre. But some chalks contain more clay than others, and are employed therefore in smaller proportions.

It acts chemically also in many ways. Thus—

1°. It improves coarse, sour, marshy pasture, and speedily brings up a sweet herbage. For this purpose it is applied at the rate of 150 to 250 bushels an acre. It is also said to root out sorrel from fields infested by this plant.

2°. On the *deep lands*, as they are called, in the wolds of York and Lincoln—where the soil which lies above the chalk is deepest—corn does not yield so well, nor ripen so early, as when a thinner covering rests upon the chalk. It is also naturally unfit for barley and turnips—the latter plant being especially infested with the disease called fingers and toes, (Strickland.) A heavy chalking of 60 to 80 cubic yards per acre removes all the above defects of these deep soils, and for a long period of time. The corn ripens sooner, is larger in quantity and better in quality, and the turnips grow perfectly free from disease. The corn land is freed also by the chalking from the troublesome spurry, (*Spergula arvensis*, locally Perry,) with which they are usually infested.

SECTION VIII.—*Effects of burned and slaked Lime upon the land.*

Pure or quick lime, like the marls and shell sands, produces both a mechanical and a chemical effect upon the soil. The former is constant with all varieties of tolerably pure lime, and is easily understood. It opens and renders freer such soils as are stiff and clayey, while it actually consolidates such as are light and sandy. In some districts it is said to stiffen one-half as much as clay. In

* *British Husbandry*, i. p. 280.

large doses it causes moorish and peaty soils in arable culture to heave, loosen, and become hollow under the foot, but it is upon such soils alone that its mechanical effects are usually unfavourable.

From its chemical action the benefits which follow the use of lime are chiefly derived. These benefits are principally the following:—

1°. It increases the fertility of all soils in which lime does not already abound, and especially adds to the productiveness of such as are tenacious, moist, or contain much inert vegetable matter.

2°. It enables the same soils to produce crops of a superior *quality* also. Land which, unlimed, will produce only a scanty crop (3 to 4 fold) of rye, by the addition of lime alone, will yield a 6 or 7 fold return of *wheat*. From some clays, also, apparently unfit to grow corn, it brings up luxuriant crops.

3°. It increases the effect of a given application of manure; calls into action that which, having been previously added, appears to lie dormant; and, though manure must be plentifully laid upon the land, after it has been well limed, yet the same degree of productiveness can still be maintained at a less cost of manure than where no lime has been applied.

4°. As a necessary result of these important changes, the money value and annual return of the land is increased, so that tracts of country which had let with difficulty for 5s. an acre, have in many localities been rendered worth 30s. to 40s. by the application of lime alone, (Sir J. Sinclair.) On the northern slopes of hill land above the Laigh of Moray the value of large tracts has been tripled by the use of lime alone.

Section IX.—*Effects of Lime on the Productions of the soil.*

1°. *It alters the natural produce of the land*, by killing or otherwise causing the disappearance of some kinds of plants, and favouring the growth of others, the seeds of which had before lain dormant. Thus it destroys the plants which are natural to siliceous soils and to moist and marshy places. From the corn-field it extirpates the corn-marigold *(Chrysanthemum segetum,)* and the corn spurry, *(Spergula arvensis,)** while, if added in excess, it encourages the red poppy, the yellow cow-wheat *(Melampyrum pratense,)* and the yellow rattle *(Rhinanthus crista galli,)* and when it has sunk, favours the growth of the troublesome and deep-rooted coltsfoot, *(Tussilago farfara.)*

Similar effects are produced upon the natural grasses. It kills heath, moss, and sour and benty† *(agrostis)* grasses, and brings up

* Bönninghausen.

† In Liddisdale, on the Scottish Border, is a large tract of land in what is there called *flying bent*, not worth more than 3s. per acre. If surface drained and limed at a cost of £2 to £3 an acre, this becomes worth 12s. an acre for sheep pasture. An experienced Border farmer assures me that such land *never forgets* 40 to 60 bushels of lime per acre.

a sweet and tender herbage, mixed with white and red clovers, more greedily eaten by and more nourishing to the cattle. Indeed all fodder, whether natural or artificial, is said to be sounder and more nourishing when grown upon land to which lime has been abundantly applied.*

On benty grass the richest animal manure often produces little improvement until a dressing of lime has been applied. This is especially the case when lime is laid upon land for the first time. The physical improvement, even, is so marked that in some instances it is said, were no other benefit derived from the application, the mere saving of labour in ploughing up would be sufficient to compensate a farmer for liming, from the more perfect and economical manner in which he would be able to work his land.

It is partly in consequence of the change which it thus produces in the nature of the herbage, that the application of quick-lime to old grass lands, some time before breaking up, is found to be so useful a practice. The coarse grasses being destroyed, *tough* grass land is opened and softened, and, as I have said, is afterwards more easily worked, while, when turned over by the plough, the sod sooner decays and enriches the soil. It is another advantage of this practice, however, that the lime has time† to diffuse itself through the soil, and to induce some of those chemical changes by which the succeeding crops of corn are so greatly benefited.

2°. *It improves the quality of almost every cultivated crop.* Thus, upon limed land—

a. The grain of the corn crops has a thinner skin, is heavier, and yields more flour. This flour is said also to be richer in gluten, a point, however, which is very doubtful, and requires experimental confirmation. On the other hand, these crops, after lime, run less to straw, and are more seldom laid. In wet seasons (in Ayrshire) wheat preserves its healthy appearance where lime has been applied, while on unlimed land, of equal quality, it is yellow and sickly. A more marked improvement is said also to be produced both in the quantity and in the quality of the spring-sown than of the winter-sown crops (Puvis.) It hardens the straw and makes the wheat a finer sample.

b. Potatoes grown upon all soils are more agreeable to the taste and more mealy after lime has been applied; and this is especially the case on heavy and wet lands which lie still undrained.

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* The liming of the pastures at Closeburn imparts a deep rich yellow to the fat of the animals fed upon it, which otherwise would have been white (Sir Charles Monteath.)

† A comparatively long period is sometimes permitted to elapse before grass land is broken up after liming. Thus at Netherby, "lime or compost is always applied to the third year's pasture, which is renovated by it, and in two or three years breaks up admirably for oats."

c. Turnips are often improved both in quantity and in quality when it is laid on in preparing the ground for the seed. It is most efficient, and causes the greatest saving of farm-yard manure, where it is applied in the compost form, and where the land is already rich in organic matter of various kinds.

d. Peas are grown more pleasant to the taste, and are said to be more easily *boiled soft*. Both beans and peas also yield more grain, (see Brit. Husb., i. p. 217.)

e. Rape, after a *half*-liming and manuring, gives extraordinary crops, and the same is the case with the *colza*, the seed of which is largely raised in France and Holland for the oil which it yields.

f. On *flax* alone it is injurious, diminishing the strength of the fibre. Hence, in Belgium, flax is not grown on limed land till seven years after the lime has been applied. Something, however, depends upon the soil.

3°. *It hastens the maturity of the crop.*—It is true of nearly all our cultivated crops, but especially of those of corn, that their full growth is attained more speedily when the land is limed, and that they are ready for the harvest from 10 to 14 days earlier. This is the case even with buck-wheat, which becomes sooner ripe, though it is said to yield no larger a return when lime is applied to the land on which it is grown.*

4°. The liming of the land is the harbinger of health as well as of abundance. It salubrifies no less than it enriches the well cultivated district. This is one of the incidental results which also follow the skilful introduction of the drain over large tracts of country. Where the use of lime and of the drain go together, it is difficult to say how much of the increased healthiness of the district is due to the one improvement, and how much to the other. The lime arrests the noxious effluvia which tend to rise more or less from every soil at certain seasons of the year, and decomposes them, or causes their elements to assume new forms of chemical combination, in which they no longer exert the same injurious influence upon animal life. How beautiful a consequence of skilful agriculture, that the health of the community should be promoted by the same methods which most largely increase the produce of the land! Can we doubt that the All-benevolent places this consequence so plainly before us as a stimulus to further and more general improvement—to the application of other knowledge still to the amelioration of the soil?

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* In East Northumberland the liming of the land, I have been told, does not hasten the ripening of the crop. It makes the land more productive and the crop larger, though not ready to cut at so early a period. This is explained on the spot, by saying that the growth of straw and ear being greater than before, the ripening is retarded by this cause. If this statement be correct, it is more probably connected with the extensive want of drainage. In Caithness bog-marl is said to make the oats later, quick-lime earlier.

SECTION X.—*Circumstances by which the effects of Lime are modified.*

These effects of lime are modified by various circumstances. We have already seen that the quantity which must be applied to produce a given effect, and the form in which it will prove most advantageous are, in a great measure, dependent upon the dryness of the soil, upon the quantity of vegetable matter it contains, and on its stiff or open texture. There are several other circumstances, however, to which it is proper still to advert. Thus—

1°. Its effects are greatest when well mixed with the soil, and *kept near the surface, within easy reach of the atmosphere.* The reason of this will hereafter appear.

2°. Among arable soils of the same kind and quality the effects are greatest upon such as are newly ploughed out, or upon certain subsoils when just brought to day. In the case of subsoils, this is owing partly to their containing naturally very little lime, and partly to the presence of noxious ingredients, which lime has the power of altering. In the case of surface soils newly ploughed out, the greater effect, in addition to these two causes, is due also to the large amount of vegetable and other organic matter which has gradually accumulated within them. It is the presence of this organic matter which has led to the establishment of the excellent practical rule—"*that lime ought always to precede putrescent manures when old leas are broken up for cultivation.*"

3°. Its effects are greater on certain geological formations than on others. Thus it produces much effect on drifted (diluvial) sands and clays—on the soils of the London, the plastic, and the wealden clays—on those of the new and old red sandstones, of the granites, and of many slate-rocks—and, generally, on the soils formed from all rocks which contain little lime, or from which the lime may have been washed out during their gradual degradation.

On the other hand, it is often applied in vain to the soils of the oolites, and other calcareous formations, because of the abundance of lime already present in them. The advantage derived from chalking thin clay soils resting immediately upon the chalk rock, is explained by the almost entire absence of lime from these soils. The clay covering of the chalk wolds has probably been formed, not from the ruins of the chalk rock itself, but from the deposit of muddy waters, which rested upon it for some time before those localities became dry land.

4°. Lime produces a greater *proportional improvement* upon poor soils than on such as are richer (Dr Anderson.) This also is easily understood. It is of poor soils in their *natural state* that Dr Ander-

son speaks.* In this state they contain a greater or less quantity of organic matter, but are nearly destitute of lime, and hence are in the most favourable condition for being benefited by a copious liming. Experience has proved that by this one operation such poor land may be raised in money value eight times, or from 5s. to 40s. per acre; but no practical man would expect that good arable land, already worth £2 per acre, could by liming, or any other single operation, become worth £16 per acre of annual rent. The greater proportional improvement produced upon poor lands by lime is only an illustration, therefore, of the general truth—that on poor soils the efforts of the skilful improver are always crowned with the earliest and most apparent success.

5°. In certain cases the addition of lime, even to land in good cultivation, and when put on according to the ordinary and approved practice of the district, produces no effect whatever. This is sometimes observed where the custom prevails, as in some parts of Ayrshire and elsewhere, of applying lime along with every wheat crop, and on such farms especially where the land is of a lighter quality. Where from 40 to 60 bushels of lime have been long added at the end of each rotation of four or five years, the land may have become so saturated with lime that a fresh addition will produce no sensible effect. Thus Mr Campbell, of Craigie, informs me of a trial made by an intelligent farmer in his neighbourhood, where alternate ridges only were limed without any sensible difference being observed. No result could show more clearly than this—that for one rotation at least the expense of lime might have been saved, while at the same time the land would have run less risk of exhaustion. Another fact mentioned by Mr Campbell proves the soundness of this conclusion. The lime never fails to produce obvious benefit where the land is allowed to be four or five years in grass—where it is applied, that is, only once in eight or nine years. The fair inference is, therefore, that in this district as well as in others where similar effects are observed—too much lime, in proportion to the farm-yard manure, is habitually added to the arable land, whereby not only is a needless expense incurred, but a speedier exhaustion of the soil is insured. Good husbandry, therefore, indicates either the application of a smaller dose at the recurrence of the wheat crop—the occasional omission of lime altogether for an entire rotation—or a more liberal habit of manuring at the same time.

6°. On poor arable lands, which are *not* naturally so, but which are worn out or exhausted by repeated liming and cropping, lime

* "I never met," he says, "with a poor soil in its *natural state* which was not benefited in a very great degree by calcareous matter, when administered in proper quantities. But I have met with several rich soils, which were fully impregnated with dung, on which lime, applied in any quantity, produced not the smallest sensible effect."

produces no good whatever* (Anderson, Brown, Morton.) Such soils, if they do not already abound in lime, are, at least, equally destitute of numerous other kinds of food, organic and inorganic, by which healthy plants are nourished—and they are only to be restored to a fertile condition by a judicious admixture of all. This truth is confirmed by the practical observation, that on soils so exhausted farm-yard manure along with the lime does not produce the same good results as in other cases. *All* that the soil requires is not supplied in sufficient abundance by these two substances laid on alone.

7°. On lands of this kind, and on all in which vegetable matter is wanting, lime may even do harm to the immediate crop. It is apt to *singe* or *burn* the corn sown upon them (Brown)—an effect which is probably chemical, but which may in part be owing to its rendering soils more open and friable, which, through long arable culture, are too open already (Morton.)

8°. A consideration of the circumstances above adverted to explains why, in some districts, and even in some whole provinces, the use of lime in any form is condemned and even entirely given up. The soil has been impoverished through its unskilful application—or, by large admixtures of lime or marl for a series of years, the soil has been so charged with it as to yield no adequate return for new additions. Thus for a generation or two the practices of liming and marling are abandoned, to be slowly and reluctantly resumed again, when natural causes have removed the lime from the soil, and produced an accumulation of those other substances which, when associated with it, contribute to the productiveness of the land.

SECTION XI.—*State in which Lime should be applied to different Soils.*

The form or state in which lime ought to be applied to the land depends upon the nature and condition of the soil, the kind of cropping to which it is subjected, and the special purpose which the lime is intended to effect. The soil may be heavy or light, covered by natural heath, in arable culture, or laid down to grass, and each of these conditions indicates a different mode of procedure in the application of lime. So the lime itself may be intended either to act more immediately or to be more permanent in its action—or it may be applied for the purpose of destroying unwholesome herbage, of quickening inert vegetable matter, of generally sweetening the soil, or simply of adding to the land a substance which is indispensable to its fertility. The skilful agriculturist will modify the form

* "It is scarcely practicable to restore fertility to land, even of the best natural quality, which has been thus abused; and thin moorish soils, after being exhausted by lime, are not to be restored" (Brown.) Chemical knowledge now teaches us how to effect what Mr Brown, with the knowledge of his time, considered impossible.

and mode of application according as it is intended to serve one or another of these purposes.

From the considerations presented in a previous article in regard to the changes which quick-lime undergoes in the air, it appears to be expedient—

1°. To slake lime quickly and to apply it immediately upon clay, boggy, marshy, or peaty lands—upon such also as contain much inert or generally which abound in other forms of vegetable matter.

2°. To bents and heaths which it is desirable to extirpate, it should be applied in the same caustic state, or to unwholesome subsoils which contain much iron, as soon as they are turned up by the plough. In both these cases, the unslaked lime-dust from the kilns might be laid on with advantage.

3°. Where it is to be spread over grass lands without destroying the herbage, it is in most cases safer to allow the lime to slake spontaneously, and in the open air than in a covered pit. It is thus obtained in the state of an exceedingly fine powder, which can be easily spread, and, while it is sufficiently mild to leave the tender grasses unharmed, it contains still a sufficient quantity of caustic lime to produce those chemical changes in the soil on which the efficacy of quick-lime depends.

4°. Where lime is applied to the naked fallow, is ploughed in, and is then well harrowed or otherwise mixed with the soil, it is generally of little consequence in which of the above states it is laid on. The chief condition is, that it be in a state of fine powder, and that it be well spread and intimately mixed with the soil. Before these operations are concluded, the lime will be very nearly in the same state of combination in which it exists in spontaneously slaked lime, whatever may have been its degree of causticity when applied.

5°. To light and thin soils, to sands and gravels which are poor in vegetable matter, to drained peats, or to heathy moor-lands, caustic lime, if applied at all, ought to be so only the first time lime is applied to them, or, if afterwards, very sparingly and with great caution.

To heaths and moors, when first reclaimed, it may be proper to add a moderate dressing of lime in the caustic state, but after they have been some time in arable culture, long-slaked mild lime or lime composts are much safer forms of cultivation. Where the land is in permanent pasture, not intended to be broken up, it is of less consequence in what form the lime is laid upon the land.

Section XII.—*Use and advantage of the Compost form.*

As there are many cases in which lime ought to be applied unmixed and in the caustic state, so there are others in which it is best and most beneficially laid upon the land in a mild state, and in the form of compost or *mixens*.

1°. When lime is required only in small quantities, it can be more evenly spread when previously well mixed with from three to eight times its bulk of soil.

2°. On light, sandy, and gravelly soils, when of a dry character, unmixed lime tends to bring up much cow-wheat (*melampyrum*) and red poppy. If they are moist soils, or if rainy weather ensue, the lime is apt to run to mortar, and thus to form either an impervious subsoil, or lumps of a hard conglomerate, which are brought up by the plough, but do not readily yield their lime to the soil. These bad consequences are all avoided by adding the lime in the form of compost.

3°. To grass lands—unless the soil be stiff clay or wet and undrained, or where coarse grass and weeds and moss are to be extirpated—it is better and safer, and has generally been found more beneficial to apply it in the compost form. The action of the lime on the tender herbage is moderated, and its exhausting effect upon soils which contain little vegetable matter is lessened, when laid on in this form.

4°. In the compost form, the same quantity of lime acts more immediately. While lying in a state of mixture, those chemical changes which lime either induces or promotes have already, to a certain extent, taken place, and thus the sensible effect of the lime becomes apparent in a shorter time after it has been laid upon the land. This is still more distinctly the case when, besides earthy matter, decayed vegetable substances—such as ditch scourings, and other refuse—are mixed with the lime. The experience of every practical man has long proved how very much more enriching such composts are, and how much more obvious in their effects upon the soil, than the simple application of lime alone.

5°. It is stated, as the result of extended trials in Flanders and in some parts of France, that a much smaller quantity of lime laid on in this form will produce an equal effect.

6°. The older the compost the more fertilising is its action. This fact is of the same kind with that generally admitted in respect to the action of marls and unmixed lime—that it is more sensible in the second year, or in the second rotation, than in the first.

In conclusion, it may be stated, that this form of application is especially adapted to the lightest and driest soils, and to such as are poorest in vegetable matter. In this form, lime has imparted an unexpected fertility even to the white and barren sands of the *Landes* in Southern France, (Puvis,) and upon the dry hills of Derbyshire it has produced an almost equal benefit. Skilful practical men say, that to moorish soils lime should never be added a second time unless in the form of compost, and that then it is prudent to lay them down to grass.

SECTION XIII.—*Effects of an overdose of Lime, and how they are to be counteracted.*

There are several effects which are familiar to the practical man, as more or less observable where lime in any form is laid too lavishly or too repeatedly upon the land. Thus—

1°. By an overdose of quick-lime some soils are hardened to such a degree as to become impervious to water or to the roots of plants. Several parts of the Carse of Gowrie were formerly rendered so hard, by the addition of lime, as to be unfit for vegetation* (Kames.) This effect I have never seen. It will be observed, I should think, only in soils which are naturally wet and undrained, or where much rain has fallen or lingered on the land after the lime has been applied.

2°. Some soils are rendered so loose by lime as to be capable of holding no water (Kames.) Upon stiff clays, a very large application indeed, and frequent ploughings, will be required to produce this effect. It happens chiefly on moorish or peaty soils under arable culture.

In many parts of Scotland, the supposed effects of over-liming on thin moorish soils, or on reclaimed peat, are frequently seen. The land is hollow to the tread—the foot sometimes sinks into it—it is open, light, and porous. Turnips and barley grow well upon it, but oats and clover refuse to yield profitable returns. It is, in fact, too light and open for these latter crops, which require a certain degree of tenacity in the soil in which their roots are to fix themselves.

This condition of the soil is usually ascribed to too large additions of lime being made, and the expression *over-limed*, applied to land in this state, seems to imply that too large a proportion of lime is still actually contained in it.

With the view of ascertaining how far this is really the case, I procured from Ballindalloch, in Banffshire, several specimens of soil in this light, porous, over-limed condition, in which they were incapable of growing oats and clover; and I submitted them to analysis. The following were the results of the examination of three of the specimens :—

	1.	2.	3.
Organic matter,	10·29	9·54	5·65
Salts soluble in water,	0·45	0·15	0·50
Oxides of iron,	2·49	3·68	0·50
Alumina,	1·71	2·54	1·11
Carbonate of lime,	1·40	0·69	1·10
Oxide of manganese,	trace	0·72	trace
Carbonate of magnesia,	trace	trace	trace
Insoluble matter, chiefly sand,	81·77	82·79	91·20
	98·11	100·11	100·06

* *Gentleman Farmer.* Edition 1802.

These results show, that so far from the proportion of lime in the soil being excessive, it is in reality deficient. Among the chemical means by which these soils are to be brought to their highest state of productiveness, the actual addition of lime, therefore, is one.

The evil called over-liming is consequently a mechanical, and not a chemical one. The extreme openness of the soil has been brought on by prolonged ploughing and too frequent cropping with corn. An opposite procedure, therefore, must be adopted, and mechanical means employed by which a gradual solidification may be effected. For this purpose several methods are to be recommended.

1°. Eating off the turnips and clover with sheep. This method is in fact found to solidify it at Ballindalloch, so as to make it capable of bearing oats.

2°. Laying down to pasture for a few years, by which the same kind of solidification from the treading of the sheep or cattle will be brought about. It is the treading of the horses as they turn with the plough, which, by solidifying them, in so many cases makes the head-ridges yield the heaviest crops. The use of the clod-crusher and the peg-roller will produce effects similar to those which follow from the treading of sheep.

3°. Ploughing shallow and as seldom as possible. The cultivator may in many cases be substituted for the plough, and thus the loosening of the land in a great degree be prevented. The subsoil plough ought to be very cautiously employed on such land, unless it be to break some hard pan beneath. I have known the clover appear very much less luxuriant on a loamy soil where the subsoil plough had been used in preparing for the turnip crop.

4°. Paring the land with the breast-plough, as is practised in Berkshire, Gloucester, and other districts, and either burning or rotting the surface, may also be tried with the prospect of advantage. No deep ploughing being thus indulged in, a firm seed-bed is left for the grain, and, if well manured, any usual crop may be sown.

5°. I ought to mention, as one of the most injurious accompaniments of over-liming, the exhaustion which the application of lime in repeated doses, for a succession of years, has hitherto almost unfailingly produced. The frequent ploughing and liming have taken place in order to force from the land frequent crops of corn. While the land was becoming lighter, therefore, it was also becoming poorer; and the full results of over-liming arise out of the operation of these two causes conjoined. While, therefore, the steps above recommended are taken with the view of restoring the mechanical firmness, others no less necessary must be taken to bring back the chemical richness of the soil, before the highest fertility of which it is capable can be successfully secured.

THE FARMERS' NOTE-BOOK.—No. XXI.

On Useful Insects and their Products.—By JAMES H. FENNELL, Author of "A Natural History of Quadrupeds," &c.—(*Continued from* p. 476.)—The time for taking or harvesting honey depends upon the locality, the state of the weather, and the lateness of the season. The proper time is when the bees begin to eat more than they gather; and this, generally speaking, takes place about the 1st of September. To deprive the bees of their honey, it is usual either to smother them with brimstone matches, or to place the hive over a pit dug in the ground, one edge of which is undermined, in order that an ignited rag, previously dipped in melted brimstone, may not be extinguished when the bees begin to fall; the removed mould being placed like a wall round the hive, to confine the smoke. "Death by suffocation," says Loudon, "seems one of the easiest, both to the bees themselves and to human feelings. Indeed the mere deprivation of life in animals, not endowed with sentiment or reflection, is reduced to the precise pain of the moment, without reference to the past or the future; and as each pulsation of this pain increases in effect on the one hand, so, on the other, the susceptibility of feeling it diminishes. Civilised man is the only animal to whom death has terrors; and hence the origin of that false humanity which condemns the killing of bees, in order to obtain their honey; but which might, with as much justice, be applied to the destruction of almost any other animal used in domestic economy." But if it is not inhuman to smother a whole colony of bees to get their honey, it is, at all events, unnecessary and impolitic. We may take the produce, and yet preserve the lives of the producers. Thorley justly remarks that, "Were we to kill the hen for her egg, the cow for her milk, or the sheep for the fleece it bears, every one would instantly see how much we should act contrary to our own interest; and yet this is practised every year with regard to bees." By the ingenious system of Mr Nutt, the famous Lincolnshire bee-master, the honey may be taken without destroying the bees. Mr Cotton, in his *Short and Simple Letter to Cottagers*, tells them never to kill a bee, as the bees may be rendered perfectly harmless without killing them, if they are subjected to the smoke from a burnt dried puff-ball, (*Lycopodium*,) a common species of fungus, called in some places the Devil's snuff-box, or Puck's fuist, which having merely an intoxicating effect upon the bees, allows of their honey being taken without any injury to themselves. Bees that are in glass hives may be immediately stupified by the fumes of burnt nitre; from which state they will recover on exposure to the atmosphere. Mr Hilton, author of the *Practical Bee-Keeper*, employs a more tractable means of stupifying the bees whilst the honey-combs are being removed. Some ether, the strength of which is more capable of regulation than that of nitre or puff-ball, is placed in a glass

vessel, to which is affixed a flexible tube, which is introduced beneath the glass hive, through a small hole in the platform on which the hive is placed. The glass vessel is then placed in a larger vessel of warm water, by which the vapour is subtilised. In about seven minutes the vapour completely stupifies the bees, who fall inanimate to the bottom of the hive—when they may be handled with impunity. On exposure to the atmospheric air, they may be quite recovered in ten or fifteen minutes. The honey is not affected by the vapour of the ether, which, besides being more cleanly, and less likely to occasion accidents than nitre and puff-ball, is so extremely volatile, that its powers are dispersed by the atmosphere almost immediately. Those who desire greater protection from being stung, should have a light canvass dress made to tie round the neck and ankles, with a head-covering of the same material, with glass eyes. Thus encased a bee-master can levy a distress on the bees after dark, without fear of suffering for his intrusion. The sting of the bee, wasp, and hornet, conveys a most irritating poison into the flesh; but it may be quickly neutralised, however, by the application of sweet oil to the punctured part.

When, under ordinary circumstances, a young queen emerges from the chrysalis, the old one frequently leaves the hive, heading the first swarm for the season. Mr Westwood contends, from the analogy between the circumstances connected with the swarming of bees, and those which appertain to the swarming of ants, gnats, may-flies, termites, &c., that this occurrence has for its principal object the union of the sexes; and that it is the newly hatched, and not the old queen which leads off the swarm. Rennie, renouncing that romantic style which writers on bees so absurdly indulge in, correctly observes that, though the queen bee has been said *to lead* the swarm, " the fact appears to be, that she is as much a follower as a leader. Swarms, indeed, will not settle nor work without a female along with them; but this arises from her being indispensable to add to their numbers, and not that her superintendence is wanted, much less indispensable." * Before a swarm leaves the hive, sure indications of the intended movement are given; the workers leave their various occupations, and collect in groups, especially near the door of the hive, as though in consultation on the important event about to take place. A writer in the *Gardener's Magazine* states that one morning, while examining a hive which he expected would send forth a swarm, he heard the cry of " peep, peep," from an old queen, whom he could plainly see going from one part of the hive to the other; running in a hurried manner, as though anxious to escape, and uttering the call in a hoarse kind of way, every time she stopped. During the time this was going on, there was another but a shriller cry of " peep, peep," from a fixed point

* *Insect Miscellanies*, p. 139.

in the interior of the hive, and consequently out of the reach of his observation. This continued about an hour, when the swarm issued forth. Mr T. A. Knight observed that, several days previous to the settling of a swarm of bees in the cavity of a hollow tree adapted to their reception, a continual succession of different bees were incessantly examining the state of the tree, and particularly of every dead knot above the cavity which appeared likely to admit water: the whole number of the bees thus noticed, in the course of three days, being such as to warrant the inference that not a single labouring bee ever emigrates in a swarm without having seen its proposed future habitation. He found that the same remark applies not only to the permanent place of settlement, but also to the place where the bees rest temporarily, soon after swarming, in order to collect their numbers. These swarms showed a remarkable disposition to unite under the same queen. On one occasion a swarm which had arisen from one of his hives settled upon a bush, at a distance of about twenty-five yards; but instead of collecting together into a compact mass, as they usually do, they remained thinly dispersed for nearly half an hour, after which, as if tired of waiting, they singly, and one after the other, and not in obedience to any signal, arose and returned home. The next morning a swarm issued from a neighbouring hive, and proceeded to the same bush upon which the other bees had settled on the preceding day, collecting themselves into a mass, as they usually do when their queen is present. In a few minutes afterwards a very large assemblage of bees rushed from the hive whence the former swarm had issued, and proceeded directly to the one which had just settled, and instantly united with them. From these and other facts, Mr Knight concludes that such unions of swarms are generally, if not always, the result of previous concert and arrangement. The bee-master is careful to watch where the swarm alights, that he may capture and place them under a new hive, wherein they immediately commence a new colony. It is singular that our peasantry still retain the ancient custom of striking a brass pan, or making some other tinkling noise, when their swarms mount up into the air, or are likely to remove to too great a distance. Such was the custom when Virgil wrote—

And ring the tinkling brass, and sacred cymbals sound.*

Thus our bee-keepers, without knowing it, are often doing the honours of Jupiter's cradle. When the infant god was concealed by his mother Cybele from Saturn, who had a custom of devouring his children, the Corybantes, her priests, were instructed to keep up a perpetual tinkling with their cymbals, to prevent the cries of the child from being heard. During his concealment the bees supplied him with their honey.

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* *Georgics*, book iv.

There is an old rhyme which says, that

A swarm of bees in May
Is worth a load of hay;
A swarm of bees in June
Is worth a silver spoon;
A swarm of bees in July
Is not worth a fly.

Mr Alexander Pettigrew, gardener, of Hampstead, adopts a very simple plan of preventing swarming, which has never failed in upwards of a hundred instances. He never suffers the hive to become too crowded, but always augments it by putting a box, or straw hive, of similar dimensions, but somewhat larger, under the inhabited hive, and closes up every aperture betwixt the hives with fresh cow-dung or mortar. Hence the bees have to descend through a hole previously cut, four or six inches wide, in the top of the undermost. If the season be favourable, the top one will be filled with honey, and sufficient store is left for their maintenance during the winter: some summers two boxes may be expected. Also, by having a box placed on each side of a hive, and barricading the mouth of the latter, it will cause the bees to pass through to the boxes, to and from work, and no doubt prevent swarming. In the *Gardener's Magazine*, Mr Wighton, a Norfolk gardener, says,—"Heat and want of room may induce swarming, if there be more than one queen or mother bee in the hive, but not otherwise. The queens will always fight till one is compelled to quit the hive: the queen who retires will be followed by a number of bees, and this constitutes a swarm." On this statement Mr Pettigrew observes, that for the queens to fight and induce swarming, is an unfounded notion, as there is but one *perfect* queen in the hive before swarming, the other queens in the hive not being hatched, sometimes for five, seven, or ten days after the swarm is gone. He has known them set the same day the swarm left; and he has, also, known a hive prepare for swarming three times; that is, by setting queens, and taking them out before they come to maturity. This is owing to the inclemency of the weather. But if the weather be fine, the queens are generally put into the royal cell three days before the swarm takes its departure; and those queens will come to maturity in eleven days after, as they are only fourteen days in hatching. The first matured queen will be heard calling, in a grunting sound, "off, off:" she hears no one answer her call; then she quits her cradle, and commences calling, in a more shrill tone, "peep, peep." It is not long till another is heard calling from the cell, in the same grunting "off, off;" but finds herself behind, as the other will answer in a moment. This will continue for three days and nights, then a second swarm may be expected. In another point Mr Wighton is incorrect, for the queen is never the first to quit the hive, and never the first to alight; but she follows the swarm to the fixed

place—as the bees always know where to go before leaving. Mr Pettigrew has seen a swarm come off without her, but soon return again. In further proof that heat and want of room are the causes of swarming, he mentions that, having put a good swarm into too small a hive, the consequence was, that, eleven days after, it threw another swarm, erroneously called a virgin swarm.

However plausible may appear the project of preventing swarming by merely opening a passage between the middle hive and a hive at the side, and compelling the bees to pass through the latter by stopping up the mouth of the former, bees will have their own way to increase their species. When we consider their manner of doing so, it can hardly be expected that the queen and swarm would settle so closely to her rivals about to come forth in the hive. Her instinctive knowledge that they will soon appear seems to be the cause of her quitting; consequently, when bees are in good condition, there can be no practical way of preventing them from swarming, for the old queen will go off with the first swarm a few days before her rivals quit their cells. Be this as it may, there can, however, be no doubt that the rivalry of the young queens is the cause of after-swarms; for they do not leave the hive until there is more than one queen. Some of our best apiarians think that the young queens go off with the swarms according to their seniority; but that is not quite clear, for it often happens that several queens leave the hive at once in a swarm. In general, it is the after-swarms that are the destruction of bees, by breaking them into small communities at a time when they cannot collect food enough to enable them to survive the winter. This not only affects the new method of bee-keeping contrived by Nutt and others, but also the old one, and most probably gave rise to the practice of destroying bees, before the plan of uniting them was known; for it would then very naturally have been thought that it was better to do this, and take their store, though little, than to let them eat it, and then perish at last. One benefit in preventing swarming is, that, in a new hive, the bees are so anxious to feed their young, that they have no spare time to gather honey; whereas, if swarming be prevented, by furnishing additional room in side-boxes, whilst half the hive is sufficient to feed the young, the other half will store honey. These side-boxes, if kept properly ventilated, will be filled with virgin honey, as the queen will never lay her eggs in a cold place. Side-boxes were introduced, about ninety years since, by the Rev. Stephen White, of Holton, in Suffolk, author of that very rare work, entitled *Collateral Bee-Boxes*, (1756); but his contrivances were without ventilators, which are of the greatest importance. A small cap-hive is sometimes of great service for the bees to work in before they swarm, and the honey, which is white, will be the first in the market, and sell at a higher price.

The system of uniting swarms at the conclusion of the honey season was first practised, a century since, by John Thorley, author of *The Female Monarchy*, 1744. It is very easily performed, though there are now several ways of going about it. One correspondent tells us that he takes both hives into a room, after taking the precaution of using smoke from cotton rags, to prevent stinging, and shakes the bees out of the hive he wants to empty upon the wood floor; then kills the queen, and places another hive over the mass of the bees. He then places a lighted candle on the hive, which attracts all the wandering ones to the light. He lets them miss the queen, and then he reverses the hive that is to receive them, that he may pour a little sugar, dissolved in water, (at the rate of one pound of sugar to one pint of water,) over the combs and bees. He next turns up the hive containing bees, and throws them into the other hive, amongst the sugar, combs, and other bees. If neither queen is killed before putting them together, probably one of them will be found dead in the morning, as the bees will not sanction two queens in the hive at one time.

Another writer recommends the following as an excellent plan of putting two swarms of bees together, or putting a swarm into an old weak hive. On the swarm leaving the hive, he shakes it into an octagonal wooden box, provided at the top with a hole three inches in diameter, which is closed by a slide on the same day; in the evening, after all the bees have gone in, he places the hive, into which he wishes the swarm to enter, upon the top of the box, which he has previously smeared with honey, and then draws the slide. The bees soon discover the opening, and pass through it to feed upon the honey in the hive; so that by next morning there is generally found in it a united family, without any of the bees being killed, or incited to sting, or quarrel with each other. Some one else recommends us, as an infallible plan, about sunset, after having drummed the bees out of one hive into an empty one, to invert the hive into which they are to be put, and throw them *en masse* into it, sprinkling a little sugar and water over them, previous to placing it on the board.

It is a curious fact, and some recommendation, that a *double hive* consumes no more honey in the winter than a single one: the additional heat seeming to sustain the vital functions of the half-torpid bees, in the place of additional food.

A French writer relates that a kind aunt of his, who took a great interest in the inhabitants of a hive, seemed to be known and respected by them. In damp and rainy weather, when their wings were chilled and torpid, she would take them in her hand, and warm and revive them with her breath. They never hurt her, but appeared grateful for her care. The celebrated traveller, Stedman, assures us that the bees at Surinam refrain from stinging those persons that live in the immediate neighbourhood of their

nests, though they will severely attack any strangers that intrude upon them. Stedman had proofs of this fact in the conduct of an enormous nest of wild bees, situated in the thatch of his hut. His servant bóy climbed up to the hive in a state of perfect nudity, but was not stung. Stedman then ventured to follow, and though he shook the nest, and made the bees buzz about his ears, not one attempted to sting him. They attacked only such visitors as were unknown to them. An old negro observed to the traveller, "Those bees would have stung you long ago, had you been a stranger to them; but, being your tenants, and allowed to build on your premises, they assuredly know both you and yours, and will never sting either you nor them." The same man related that on his master's estate was an ancient tree in which had resided, ever since he could remember, a society of bees, and another of birds, both living in the greatest harmony. But when any strange bees dared to venture near the birds' nests, the native swarm attacked the invaders, and stung them to death; and when any strange birds came to disturb or feed upon the bees, they were instantly repulsed by their feathered allies. He added that his master's family had so much respect for the above association, that the tree was considered as sacred.

In Lithuania, when the master or mistress of the house dies, it is considered necessary to give notice of the fact to the bees, horses, and cows, by rattling a bunch of keys; and it is believed that if this were omitted the bees and cattle would die. In Lower Brittany, whenever a death occurs in the owner's family, the bees are put in mourning by dressing the bee-hives in black; and whenever a marriage or any other joyous event takes place, the bee-hives are decorated with red cloth. The simple peasantry think the bees would take offence, and desert the place, if they were not allowed to participate in the feelings of the family on such occasions. In Wales, a swarm of bees settling on the ground is regarded as a sure token of a death in the family; and it is believed that, a short time previous to the death of the master, the bees themselves will die without any apparent cause. The Rev. James Rudge states that, at Hawkchurch, Dorset, it is customary, whenever a corpse is carried out of a house for interment, to raise and turn round the bee-hives; it being thought that, if this were not done, the bees would die, or some mishap befall the surviving relatives. At Rattray, in Devonshire, it is also an old saying, that bees will die as soon as the master is buried, if, on the body being taken out of the house, some one does not whisper into the hive, "The master is dead!" Every old person in the parish can relate an instance of this within his own knowledge. This superstition prevails, too, in other parts of England among the uneducated. Usually some person takes the key of the house, and (to observe due form and ceremony) knocks with it three times against the hive, telling the

bees, at the same time, that their master or mistress, &c. (as the case may be) is dead. Loudon, when in Bedfordshire, heard of an old man there who sung a psalm in front of some hives which were not doing well, but which he superstitiously fancied would thrive in consequence of that ceremony.

The origin of the "honey-moon" is from the custom of the higher order of Teutones, an ancient Gothic people of the northern parts of Germany, who drank mead or metheglin, a beverage made with honey, for thirty days after the wedding. A traveller who resided for eight years among the Circassians, says, that in September they have a honey feast—that is to say, they celebrate the fête of Mercime, their patroness of bees. They say that the thunder, in anger, exterminated the whole of these industrious insects, except one which Mercime concealed in the sleeve of her chemise, and this one reproduced the species. Such is the fable, and all the homage paid to her consists in regaling, on her holiday, with meats and liquors prepared from honey.

Hand-Book of Chemistry applied to Agriculture, &c.—By Dr. C. R. Fresenius.*—Dr Fresenius has for some time been known, more especially by two standard works on Analytical Chemistry; and we confess that we hailed with pleasure the announcement of a work on agriculture from his pen, well knowing that, if even it contained nothing original, we would at least have the worth of our money in the way in which the information would be arranged. In this respect the works of Fresenius are second to none of the present day. It has justly been complained of, in one of the periodicals, that there is a growing carelessness of both authors and publishers in giving a proper index to their works. No fault of this kind can be found with that now before us, as it is *all index*, if we may be allowed such an expression. Any one who has studied Euclid's Geometry in his younger days will understand our meaning. No one would ever think of an index to that book, because every thing flows so naturally from what goes before, that any part required can be easily found. In much the same style are all the works of Fresenius which we have hitherto met. Contrary to many writers, there is nothing taken for granted, nor are there any theories built upon unsafe or uncertain deductions. But the whole style is so peculiar, that we must refer to the original for a full confirmation of what we have said in its praise. Dr Fresenius has well laid down his plan in the Introduction, and amply redeemed his word in the course of the work. He says, "I have never presupposed chemical knowledge in my readers, but every paragraph in the book will be perfectly intelligible to any one who reads what precedes it."

The subject is treated under the following heads :—

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* *Lehrbuch der Chemie für Landwirthe.* Bei Von Dr. C. R. Fresenius: Braunschweig, 1847.

1. Introductory.
2. The elementary bodies, and their inorganic combinations.
3. The chemistry of the vegetable kingdom.
4. Chemistry applied to agriculture, &c.
5. The elements of chemical analysis.

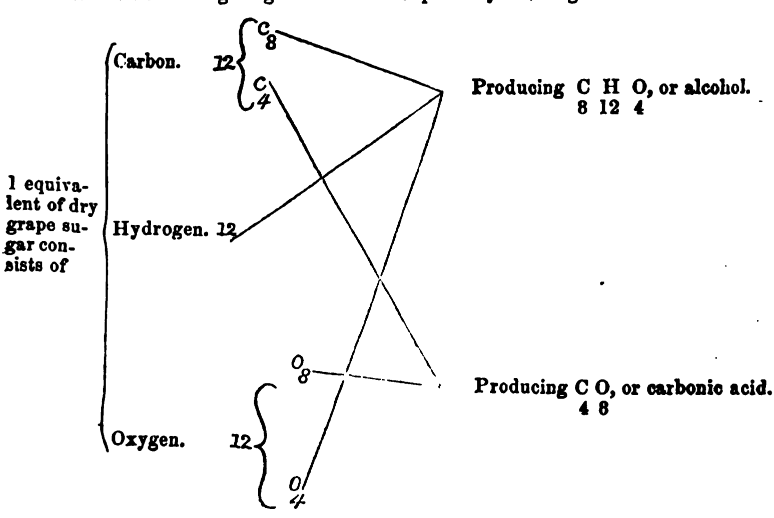
It is of course impossible, as it would indeed be out of place, to attempt to give any outline of the first and second sections, embracing as they do almost all chemical science; we shall therefore confine our remarks to the third and fourth divisions.

The third section contains a very well arranged series of analyses of the various grains, roots, fruits, trees, &c., which are commonly cultivated. Many of these analyses are by Professor Way, and, though few of them are original, they are the most complete collection yet published. Let not the farmer despise such labours, though as yet he sees little good arising from them: the time will undoubtedly come when he will reap some benefit. As an example of the peculiar style and arrangement of the work, we select the following explanation of the vinous or alcoholic fermentation:

1. For alcoholic fermentation there must be—
   a. A solution of sugar of sufficient strength.
   b. A substance capable of producing fermentation; or, in other words—
      α. A ferment.
      β. And yeast.
   c. A proper temperature.
2. Alcoholic fermentation consists of—
   a. A breaking up of the chemical constituents of sugar, and a re-arrangement of them as alcohol and carbonic acid.
   b. A change—
      α. Of the ferment producing more yeast.
      β. Of the yeast, leaving only decomposed yeast.

During this change in the ferment and yeast, the sugar gradually disappears.

3. This wasting, or breaking up of the elements of sugar into alcohol and carbonic acid, is such, that analysis can prove that none of the elementary parts of the sugar are lost. The following diagram will best explain my meaning:—



4. This fermentation goes on until—
   a. All the sugar disappears.
   b. Or until all the ferment, or all the yeast, is converted into decomposed yeast.
   c. Or until the fermentation is stopped by—
      aa. Lowering the temperature.
      bb. Or by adding a sufficient quantity of alcohol.

In like manner, in another place, after stating that all food is consumed in the animal system either—

1. To maintain animal heat.
2. To repair waste ; or
3. To form new parts ;

he then proceeds to say that

All these three processes are carried on at the same time in every part of the body, by means of the blood.

It would be tedious to give his arguments at length respecting the effect produced by various kinds of food upon these three vital processes, but will content ourselves with the following summary, which contains all that is at present known upon this important question. He considers milk as the pattern of all food, as it evidently contains within itself the means for carrying on the above-named three fundamental processes; namely—

a. *Nitrogenous organic bodies*, as casein and extractive matter, which, we believe, go both to repair the waste and increase the animal substances.
b. *Carbonaceous matters*, as butter and milk-sugar, which go to maintain animal heat and the formation of fat.
c. Milk also contains such salts as are necessary for the formation of bones ; namely, chloride of sodium, chloride of potassium, phosphates of lime and magnesia, and—
d. Water, which is necessary for all the processes of life.

Our author then proceeds to inquire, in the various articles consumed as food—

1. Which constituent part of them takes the same place as the casein, or nitrogenous part of the milk ?
2. In what proportion are the nitrogenous and carbonaceous matters found in the various substances used as food ? and what quantities, and what kinds of inorganic salts, do we find combined with these organic substances ?
3. What proportion between the nitrogenous and carbonaceous food is best adapted to man, and also to animals, both in a normal and abnormal state ? and what effect has the amount of inorganic salts they contain upon their relative value ?
4. In what proportions must man and animals use the various natural or prepared foods and drinks, so that, without injury, and with the least possible waste, we may go straight to the desired result ?

In answer to Query No. 1, Fresenius states as his opinion—

1st. I am of opinion that all protein substances, as albumen,* fibrin,† legumen,‡ gluten, &c., takes the place of casein.

* The white of an egg.
† The flesh of animals.
‡ Found in beans, pease, and so closely resembles casein, that some chemists have supposed them to be identical.

2d. I am also of opinion that starch, imelin, gum, pectin,* sugar, the fatty bodies, &c., take the place of the carbonaceous part of the milk.

In answer to Query No. 2, we make the following extracts from a more extensive table :—

Vegetable food, &c.	Proportion between the nitrogenous, carbonaceous, and inorganic salts in vegetable food, &c.		
	Nitrogenous.	Carbonaceous.	Inorganic salts.
French beans,	1	1·81	0·15
Linseed,	1	1·87	0·09
Field beans,	1	2·08	0·15
Pease,	1	2·14	0·11
Wheat,	1	2·42	0·11
Oats,	1	4·08	0·24
Barley,	1	4·25	0·27
Rye,	1	4·42	0·13
White turnips,	1	6·39	0·55
Potato,	1	9·00	0·40
Oat straw,	1	12·50	2·04
Wheat straw,	1	12·20	2·48
Rice,	1	14·8	0·10
Meadow grass,	1	8·3	0·73

Animal food, &c.	Proportion between the nitrogenous, carbonaceous, and inorganic salts in animal food, &c.		
	Nitrogenous.	Carbonaceous.	Inorganic salts.
Beef, cooked,	1	0·016	0·04
Good common soup,	1	0·044	0·26
Veal, cooked	1	0·051	0·04
Fowls,	1	0·104	0·08
Mutton, cooked,	1	0·125	0·05
Pigeons, cooked,	1	0·146	0·05
Shellfish, boiled,	1	0·174	0·05
Ham, cooked,	1	0·199	0·04
Salmon, boiled,	1	0·778	0·07
Cow's milk,	1	1·777	0·13

I shall endeavour to present the conclusions to be derived from this table, in answering the following questions.

In answer to Query No. 3, Fresenius acknowledges himself indebted to the researches of one of our own countrymen, Thomson, who, in his researches on the food of animals, first gave us an insight into this most mysterious process of nature. In the work above named, Thomson finds fault (and in our opinion justly) with the practice of stall-feeding, and recommends box or warm yard-feeding as being preferable, and more suitable to the natural habits of our domestic animals. Thomson's researches have satisfactorily—

* Found in turnips.

Shown that an animal requires that its food should contain nitrogenous and carbonaceous food, in the proportion of 1 to 5. And yet, in a mixture of turnips and oat straw, we find that they are in the proportion of 1 to 10; so that we have not only the pecuniary loss attending the waste of the 5 parts of carbonaceous matter, bnt also the animal will be weakened by the probable loss of part, if not of the half, of the nitrogenous part. This loss might undoubtedly be saved by the addition of more of the latter to the food mixture.*

A horse which works hard will require its food to contain the two parts in the proportion of 1 to 4. We therefore give it oats and hay, and if we give it oat straw, we must make up the deficiency of the latter by the use of beans.

A man requires that his food should contain the nitrogenous matters in the proportion of 1 to 3. He therefore eats a mixture of beef or mutton.

We think, that with respect to cattle, the relative proportion of nitrogen and carbon in their food is over-estimated: meadow grass contains them only in the proportion of 1 to 8, and yet there is no food on which animals do better. On the other estimates we are unable to give an opinion, as Fresenius has neglected to give us the calculations by which he has arrived at them.

In answer to Query No. 4, with all due deference to our author—whom we have followed most obsequiously so far—we think that chemistry has not yet attained quite to such a degree of perfection as to enable us to answer this question, at least to our own entire satisfaction. It will be seen by the tenor of the previous remarks, that Fresenius calculates the value of an article of food by the *relative proportion* in which nitrogen and carbon exist in it. In this respect he is undoubtedly in advance of those who do so from the quantity of nitrogen alone. There is, we fear, yet some hidden secret for chemistry to discover. Fresenius, in answer to Query No. 4, by calculating from the foregoing tables, proposes to substitute for a certain weight of meadow hay a certain weight of clover hay and potatoes mixed; and perhaps in this instance he may be correct. But we wish to show that there are other influences to take into account. Suppose, for instance, we carry out the above example of substitution to its full length, and we wished to feed an ox, instead of on clover hay and turnips, with deal shavings. Well, in order to make its second food mixture (the deal shavings) equal to the first, we have only to use a certain quantity (which we may calculate from the tables) of oats; and yet every child knows that the animal would starve upon such a dietary. How is this? The fault is hardly in the deal, for it contains carbon, a portion of nitrogen, and inorganic salts, and ought, according to the table, to go so far as food, which experience would almost flatly contradict. The fault then is not, as a lecturer on this subject lately remarked, in the deal board, but in the animal's stomach, which was unfortunately not made to digest such a material. We mean by the above remarks *to show, that the state of chemical combination in which the carbonaceous, nitrogenous, and inorganic matter* exists in food must influence the rela-

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*** These remarks, of course, only apply to a full-grown animal.**

tive value of that food nearly quite as much as their relative proportions.

The following are our author's own conclusions on this much disputed, and as yet imperfectly understood question:—

1st. It is impossible to support the life of either man or animal by the use of carbonaceous food alone.

2d. All that has previously been said by writers on agriculture, on the relative value of various articles of food, as far as it is the result, not of actual practice, but of theory, cannot possibly be correct, because the theory is in this case at total variance with facts.

3d. The knowledge of the true relative value of various kinds of food, and the proportions in which they should be combined, can only be obtained by great labour. Chemistry and agriculture must work together, if ever we are to have a satisfactory solution of the difficulty.

4th. When this is done, we shall then be able to arrange such a natural system of diet that, without any waste of food or strength, we shall arrive at the best results.

But no department of agricultural chemistry is treated with so much clearness as that which explains the origin of the various elementary parts of vegetation. We shall again have recourse to our author's own words.

1.—*On the probable origin of the carbon of plants.* It is derived,—

1st. From the *atmosphere*, which always contains carbonic acid.

2d. From *water*, which reaches the plant in the shape of rain, snow, dew, &c. In their passage from the clouds to the earth, the drops of rain always bring down portions of the carbonic acid of the atmosphere.

3d. The *soils* always contain carbon—

a. In the form of carbonate of lime, magnesia, and the alkalies.

b. In the form of decaying vegetable matter.

c. In the form of free carbonic acid.

4th. The *seed* also contains carbon.

2.—*Probable origin of the hydrogen of plants.*

1st. The *atmosphere* always contains the vapour of water.

2d. From *water*, which is conveyed to plants in so many ways.

3d. The *soil* contains many minerals which hold water in a state of chemical combination.

4th. The *seed* also contains hydrogen.

3.—*Probable origin of the oxygen of plants.*

1st. The *atmosphere* contains, (1.) oxygen in a free state; (2.) in combination with carbon, as carbonic acid; and (3.) in combination with hydrogen, as water.

2d. From *water*.

3d. From the *soil*.

4th. From the *seed*.

4.—*Probable origin of the nitrogen of plants.*

1st. The *atmosphere* contains free nitrogen and a small quantity of carbonate of ammonia.

2d. *Water* always contains more or less of both carbonate and nitrate of ammonia, derived from the atmosphere.

3d. All soils contain—

a. Ammonia, which they have absorbed from the atmosphere.

b. And also ammonia, which has been derived from decaying vegetable substances.

4th. The *seed* also contains nitrogen.

5. Probable origin of the sulphur and phosphorus of plants.

1st. The *atmosphere* contains traces of sulphuretted and phosphoretted hydrogen.

2d. *Water* indirectly supplies sulphur, by decomposing the sulphurets of the metals.

3d. The *soil* always contains sulphur, in the form of sulphate and sulphurets, and phosphorus, in the form of phosphates.

4th. The *seed* also contains both sulphur and phosphorus.

We do not think it necessary to follow our author through his detailed proofs of the correctness of his views on the numerous questions involved in the foregoing quotation, except with regard to the origin of nitrogen, because it involves a question of practical importance.

Many chemists, with Liebig at their head, maintain that the carbonate of ammonia, which exists in the atmosphere as a gas, or in solution of the aqueous vapour, snow, or rain, by means of which it is conveyed to the soil, where it is held mechanically, thus supplies the plants with nitrogen.

Other chemists again, with Mulder at their head, assert—

That the atmosphere contains a quantity of ammonia, which as yet it has been found impossible to weigh, and which, to organised matter, is but of secondary importance.

Nitrogen, in the state of pure gas, and also atmospheric air, are, however, possessed of one common property—namely, that when in contact, within an inclosed space, with putrifying substances, from which hydrogen is given off, the nitrogen combines with the hydrogen, and forms ammonia.—MULDER'S *Chemistry, by* JOHNSON.

Others, again, think—

That the nitrogen of plants is derived from the decomposition of nitrogenous substances, and which may be replaced by salts containing nitrogen. At all events, we are quite sure no one has yet proved that the nitrogen of the atmosphere is directly available to supply the wants of vegetation.

Amidst such opposite opinions, broached by men of reputation, we are disposed, with Fresenius, to follow a middle course, and admit—

1st. *That many plants may have the power of supplying themselves with nitrogen from the atmosphere; and*

2d. *By far the larger and more important part of vegetation requiring nitrogen is supplied by the decomposition of matter already existing in the soil, or from ammoniacal salts or nitrates, either applied directly, or derived from the decomposition of nitrogenous matter applied to the soil as manure.*—(SCHATTENMAN, KUHLMANN, &c.)

In this latter opinion we are disposed to agree most cordially, and would again take an opportunity of urging upon farmers the necessity for carefully husbanding all the ammonia of their farm-yard

manures; and to those who prepare the superphosphate of lime for themselves, we would recommend the addition either of sulphate or muriate of ammonia, or nitrate of soda, as by doing so they will much improve their manure. But the subject of manures is so important, and so little understood by the generality of farmers, that we will again resume the subject, as it seems to be worthy of something more than a mere passing notice at the end of a paper.

M. B.

The Outlines of Plantations.—By D. GORRIE, Annat Cottage, Errol.—Though existing in the midst of material objects, that are finite and limited in number, extent, and duration, there is something in the human soul, indicative of its immortality, that causes it to long after a state of boundlessness; to be impatient of confinement; and to take pleasure in extent, continuity,—whatever seems to go on in an unbroken line, or a ceaseless progression,—whatever shadows forth infinitude. And there is something like mental pain experienced on the contemplation of any object that is marked by unseemly abruptness, that is wanting in one or more of its parts, or that has lines broken and confused, which evidently, to the eye of reason, should have been continuous, and straight or flowing. There is, moreover, a feeling of impatience in the mind when the range of the eye is limited in such a way as to divest the imagination of the idea that there is something beyond the sky-line of vision,—a continuity in the scenery, though it cannot be seen.

The beauty of a carriage-wheel is marred if one of the spokes be amissing. A broken hoop has lost the attractiveness to the eye which is possessed by a complete circle. An individual object wanting in a row of similar individuals, whether columns, arches, trees, or geometrical flower-beds, must be supplied ere the effect of the rest can be complete. Such examples may serve to illustrate that lack of beauty in artificial objects which is caused by brokenness, abruptness, or want of any essential part.

But continuity, as the term is used by landscape-gardeners in relation to objects in natural or artificial scenery, has dealings with the imagination. It provides against the supposition that the universe is bounded by our limited range of sight, and aids the mind in realising the existence of other scenery,—whether composed of land or water, of rocks, hills, or trees—beyond that which lies before us. A bending sheet of water is pleasing when it appears to be continuous like a river, but disappointment is felt when, on moving a few steps forward, the spectator discovers that it is but a pool or mere, abruptly terminated by an artificial mound or retaining wall. An avenue is pleasing when its termination is lost over the brow of a distant rising ground, and when

imagination of a person looking along it is left, so to speak, sweep onwards with nothing to keep it in check; but when an enue ends abruptly on level ground, and has its termination rked by an obtrusive obelisk, statue, or vase, it lacks one of the ncipal ingredients that combine to constitute agreeableness. ere is a similar principle in the art of oratory. When a lecture speech ends with the complete exhaustion of the ideas which it y have been its object to develop,—when there is nothing more t for the speaker to say,—it is liable to be counted wearisome, ugh perhaps only of half an hour's duration; but when the tor, at the end of his discourse, so manages as to have the minds his hearers filled with some grand, some unexhausted idea, ving them to carry it onwards in their own thoughts after his ce has ceased sounding in their ears, they are pleased; weari-neness is not in their thoughts, though the address may have ted an hour or more, and their imagination flows onwards, con-ing up what the speaker might have said had he continued his tion. A popular speaker, amongst his other qualifications, is that acknowledges the principle of continuity, and refrains m exhausting the ideas which he may have succeeded in bring-before the mind's eye of his hearers. But to return to matter: the reader suppose himself in a ship in the middle of a vast e, exactly circular, and that the surrounding line of coast ap-rs like a low blue wall in the distance, with no appearance of outlet, and he will feel himself under a kind of restraint, ough thirty miles of unobstructed water may be stretched on ry side. If the coast be broken, the waters meeting the sky some parts, and bold headlands advancing in others, the effect quite different, the feeling of restraint vanishes, and all because waters appear to be continuous. Or let him imagine him-sailing through an archipelago, with islands of various shapes l sizes, and at various distances, rising around him—some of m low and flat, and others rising to a towering height, their tonic rocks frowning on the waves that rage around them; ne of them contiguous, and others scattered at wide intervals— l he may be delighted at seeing, here and there, unbounded ex-nses of water stretching away to the horizon, and even kissing blue sky away beyond the lower islands that lie in mid dis-ce. The effect is complete: the mind is satisfied in its wonderful e of infinitude; and, already imagining itself beyond the outer-st islands, with the blue expanse of ocean still stretching cease-ly onwards, is ready to indulge in feelings and ideas that may expressed in these words—words supposed to form part of an ortunate mermaid's song, on her escaping to her native ers from a state of cruel captivity endured under the hand of n;—

Oh now I am as free
As the blue waves of the sea,
And to other seas I'll hasten away.

The principle of continuity in scenery is best developed, and most easily acted on, where there is a mixture of different objects. It enters more pleasingly into the imagination in the case of a partially land-locked sea, such as has just been described, where there seems to be restraint in one or more directions, than on the wide ocean, where there is no obstacle for the mind to exercise itself in the pleasing task of overcoming. Continuousness of one solitary feature in scenery may become wearisome. The honest Scottish emigrant, of whose first impressions of the New World we are informed in story, wondered at the seemingly ceaseless, and certainly monotonous, array of trees which shut the view on every side of the noble American stream, on which he had continued sailing for days while journeying towards his adopted home in the backwoods, and inquired, in his simplicity, whether such a long plantation could all belong to one laird. There was monotony here, but not continuity. There was nothing to indicate that the forest did not terminate with its most distant visible portion. A tenth part of the number of trees, arranged in masses of certain shapes, and interspersed with open sweeps and glades of corn or meadow ground, would have been sufficient to banish monotony from the scene, and to indicate to the imagination of the beholder that there was other scenery beyond the distant, or neighbouring, frontier of table-land, or beyond the next curve of the stream.

A few of the ways by which this effect can be secured, either by the aid of artificial plantations or of the spared portions of ancient forests, may here be noticed. To search out the whole of them would be to adapt our principle to every existing shape and form of ground that aids in producing the wondrously variable character of the surface of our globe,—a task which it is both unnecessary and impossible to perform.

In no part of this country is there a level tract of land so wide as apparently to extend to the horizon on every side of the spectator. Hills, mountains, or low rising grounds, bound every landward view, at least in some directions. When mountain ranges are so distant as to appear of one unvarying line, this effect of aërial perspective prevents such comparatively small objects as trees from appearing as distinct features in the landscape. But when the materials of scenery are so near the observer as to exhibit something of their own natural qualities, their arrangement, in so far as they are transposable, becomes an affair in which the landscape-gardener may exercise his genius in endeavouring to produce an effect that will be pleasing to the eye. And it is by aiding the imagination rather than by conveying practical information to the

mind, that some of the most gratifying examples of scenic effect can be produced. The imagination is the first faculty of the mind that is exercised when the eye receives the reflection of objects in rural scenery. Topographical knowledge holds a secondary place in the estimation of the beholder. And even though the results of an exercise of the imagination, and a knowledge of facts in regard to the geography, elevation, aspect, or appearance of places hidden from the view by nearer objects, be at variance, still the first impressions continue to please; and the ideas of the mind's own creation are preferred, although, when the reign of the imagination for a time ceases, they are known and felt to be at variance with fact. If, by a certain arrangement of trees sweeping over the brow of a hill, the impression is conveyed that woods stretch away down the other side, the spectator is pleased, although he may be aware that the plantation terminates with the farthest off tree, whose top is just scarcely seen appearing in perspective above the sky-line of the ground. For the very idea of continuity is pleasing; and it is easy to imagine that the absence of objects fitted to excite this idea aided in rendering unhappy and dissatisfied the captive Rasselas in the so-called Happy Valley of Abyssinia. He was placed in a situation of surpassing, yea, enchanting loveliness and beauty, and wanted for nothing of earth's enjoyments; but the high and stern rocks which bounded the valley on every side, rising up like a wall of adamant towards heaven, not only rendered escape from the valley impossible, but even seemed, from their very appearance, to be the boundaries of creation; and this idea might have been painfully impressed on the mind of the captive prince,—although he was, in fact, aware that other countries extended beyond them. The sorrows of Alexander Selkirk were, perhaps, greater while he surveyed his lonely island "from the centre all round to the sea," than when his view was confined by some inequality of ground, behind which *there might be*—continuity.

A line of plantation running horizontally along the upper part of a brae-side, the brow of a rising ground, or the slope of a piece of table-land, and forming by the tops of its trees the sky-line of the landscape when viewed from an adjoining plain or valley, tends to divest the mind of the idea that the scenery is continuous behind the range of vision. The long and formal line of unbroken wood seems to be a boundary. If there is ground behind it, that ground is surely of a different character from the stretch that lies between the spectator and the plantation—or it must belong to a different proprietor; and the very idea of a march fence is disagreeable to a person looking at a landscape for its own sake alone, and having the truth impressed on his mind that the earth, and the fulness thereof, belongeth to One Being,—and that as in all His works there is a harmonious unity, so it is right that one portion of earth's fair scenery should melt into another, and that no part should stand out

in harsh relief as distinct from the rest. In the case we have supposed, where the trees are already in existence, the axe may be able to effect what the planter's spade has been the means of preventing. By cutting down some of the trees the formal line may be broken, the brow of the hill may be made to meet the sky in some places, and in others may be brought into view the tops of trees receding in perspective on the other side. Supposing table-land to extend beyond, the effect will be similar, for the edge of such ground will appear to be the brow of a hill to a person looking upwards from a valley or plain. But if the plantation be to form,—if no trees exist to which the axe can be applied,—means should be used to insure the effect of continuity before the planter commence his operations. Instead of laying out a formal belt along the summit of the ground and parallel to the horizon, it may be commendable to design an irregular zone of woodland, sweeping slant-wise up the brae-side, and continuing in the same direction after passing the summit, so as the tops of the trees on the other side may be seen receding in perspective. This zone may be varied in its outline, and may in some places be broken up into separate portions, as the milky way is divided in part of its encircling course; or irregular groups of trees may vary the scene; or two or more zones, if the ground is extensive, may unite in producing the desired effect; and their outlines and directions may vary,—one stretching away in a straight line, or nearly so, and another enclasping the ground, crescent-wise, as the new moon does the old. If, amongst the materials, there be a conical knoll rising higher than the rest of the ground, the trees may recede behind it on either side, allowing part of its outline to meet the sky. If there be wrinkles on the brow of the hill—little valleys running along, or up and down—they will be deepened by keeping their lower parts clear of wood, or their existence will be made known by forming vistas, glades, or recesses amongst the trees. In park scenery, where profit is less an object, the improver will be comparatively uncontrolled by extraneous considerations; but amongst arable ground he will have to consider in what way beauty and utility may be best combined by confining the trees to the poorer and less productive portions of the ground; and this, in most cases, will not be a very difficult task, for, generally, the higher and poorer portions of the soil are those which the landscape-gardener will choose to plant. Shelter, also, may easily be combined with beauty; for, to say no more, a formal belt, such as we have been speaking of, can only give shelter in one direction; whereas the zones and groups which have been recommended may be so arranged as to give shelter from every wind that blows.

Round or oval-shaped clumps of trees, whether placed on lawns, hill-sides, or the summits of conical knolls, form incongruous features in every kind of scenery, save what is avowedly geometrical. They

have, doubtless, been recommended on high authority, and have been adopted in numerous instances by professors of modern landscape gardening; but they certainly detract from the real beauty of the scenery into which they are admitted. Apparently thrown down here and there at random on level ground, there is no ideal chain of connexion between them to indicate continuity; and, placed on the summits of rising grounds, they fail in communicating the idea of unseen stretches of scenery, and seem like sentinels relieved against the sky, and having relation only to what is visible and real. The harsh and obtrusive appearance of their outlines shows that art has claimed all to itself, where it should only have been a quiet and unintruding servant of nature. Broken into irregular masses, made to conform themselves to the natural shape of the ground on which they stand, linked together by single trees, and apparently connected with imaginary woodlands hidden from the view, they cease to be disagreeable, and become important agents in the production of pleasing scenery.

When the higher or convex portion of a hill is covered with wood, and its lower or concave part left open, the fence that divides the open from the planted ground is often seen running horizontally along the hill-side, just at the place where, when a sectional view of the hill is obtained, convexity should change insensibly into concavity, thus realising the "line of beauty." This imaginary line is destroyed when an evident mark, such as the edge of a plantation, is placed at the intermingling of the different sweeps. Lines of fence parallel to the horizon are, therefore, to be avoided on hill-sides.

However extensive a forest or plantation may be, it has a hampered appearance when its boundaries are strongly marked. It matters not essentially whether the line of fence be straight, or whether there have been an inefficient attempt made by art to produce a "line of beauty," by laying down formal sweeps and curves—there is a want of connexion between the different parts of the landscape in either case. It was carrying the rage for Hogarth's ideal line too far to direct, in every case, the course of plantation fences according to its rules; and many of the parks laid out about half a century ago bear living witness, by their monotonous sweeps and curves, to the absurdity of allowing fashion and novelty to assume the place of reason. It would have been much better had the designers of such park scenery kept the line of beauty in its own place, and disguised the boundaries of their plantations and lawns by such sweet recesses and glades, such rugged breaks, bold advancing masses, and scattered single trees, as may be seen along the edge of ancient natural forests, where the hand of man has not been employed, where one part of the landscape melts gradually into another, and where no part harshly separates itself from those around it.

In planting undulating ground, where there is every variety of shape, and every gradation of size, from that of principal down through secondary valleys, including corries and glens, to the lesser hollows that diversify a hill-side, there are innumerable opportunities of arranging masses of trees so as to produce imaginary continuity of scenery, which the landscape-gardener ought to improve to the best advantage. In rocky scenery, as much depends on the kind of trees planted as on the vertical profile of the ground which they occupy. The tops of straggling firs appearing from behind a ledge of rocks will convey the impression that the scenery beyond is similar in character to that within sight; whereas round-headed trees, appearing in a like position, would seem to indicate that the ground behind is no longer rocky, but composed of a deep and fertile soil. Where trees of particular kinds are collected into masses, according to the soil which they grow best upon, the connecting points between two such masses should be rendered undiscernible, by intermingling the different kinds of trees whereof they are composed, so as to produce a gradual change from one form of head and colour of foliage to another.

The formal belts that surround many modern parks are often more displeasing than the boundary fence which it is their object to conceal. They render it more visible, because they make its existence more evident than it would otherwise have been.

Permanent fences are, generally speaking, incongruous objects in modern park scenery; and many ways have been invented of rendering them invisible. Of these may be mentioned the employment of wire-railings painted green, sunk-fences, and walls or palings so placed along the bottom of hollows as to be seen over while they remain invisible. Invisible fences are not to be commended in all cases, even in natural garden scenery; for an evident appearance of necessary protection and safety to certain portions of ground, such as flower-gardens and shrubberies, from the intrusion of deer or cattle inhabiting an adjoining park, is requisite, in order to complete the congruity and comfortableness of the scene. Fences formed of movable or perishable materials are less offensive to the eye in picturesque scenery than those that have a permanent character, because the object of their erection seems merely to be temporary. Stone walls or clipped hedges, when they sweep round a plantation, rigidly enclosing every tree, tend to mar continuity, and indicate exclusiveness on the part of the proprietor to whom the wood may belong; but these injurious effects in scenery are easily avoided by having masses of trees without the fence, at some places, of the same age and species with those immediately within it. When a policy wall recedes a little from the public road at a gate lodge, allowing some of the trees, which might have been enclosed, to stand free and unconfined—and when similar trees stand on the other side of the road, uniting the park scenery with the

agricultural, the idea of liberality on the part of the proprietor, and of continuity in the scenery, is impressed on the imagination.

In ancient gardening, fences were principal and conspicuous objects. Formed in countries still for a great part in a state of nature, wild and uncultivated, and inhabited by men only partially civilised, the gardens of old times required high and prominent fences to communicate to them the appearance and the reality of security and privacy. And in as far as these essential agents in producing comfort, enjoyment, and advantage, are necessary in modern times, the idea of utility will render fences agreeable objects, which, devoid of such considerations, are the reverse. But even ancient landscape-gardeners aimed at continuity; and they, in part, attained their aim, by means of seemingly interminable avenues stretching away for miles from the windows of a residence, or of long glades and vistas cut through or into a neighbouring forest. A feeling of comfort pervades the mind of a person walking in a snug and well-fenced and sheltered garden or shrubbery; but this feeling is in no way lessened although a distant hill may be seen over the objects forming the foreground of the picture. Even a peep at far-off scenery, through the trees surrounding a hermitage, detracts not from the seclusion thereof, while it may be a source of enjoyment to the solitary inmate. Vistas originated in that love of seeming infinitude so natural to the mind of man.

It is not a sense of property in the soil, or of lordship over it, that confers pleasure on the beholder of a scene fitted to excite ideas of continuity. Were it otherwise, such pleasure would be denied to all save landed proprietors; whereas, it might form a subject of inquiry whether a passing stranger, having no earthly connexion with the scenery stretching out before him, may not enjoy the beauties of a landscape more really and more purely than he to whom it belongs, and whose feelings, it may be, are partly of an interested nature, with a latent tendency towards materialism and considerations of profit. It is not indeed necessary, from the order of things, that this should be the case. A proprietor's enjoyment of scenery may be equally pure with that of any other person; but all that is meant is, that such enjoyment is not of a perfect kind, —not ethereal, not mental,—unless feelings of worldly interest are either banished, or have no existence. There is, doubtless, a certain species of pleasure and enjoyment which may result from the consciousness of possessing any thing that is beautiful, and being able to call it our own. The amiable Repton felt this in a high degree when he anxiously retired from the allurements of active life, to cultivate his own little garden at Harewood; and who that has been the owner of a garden, however small, but can sympathise with the feelings which prompted that eminent landscape-gardener to say, that he enjoyed a certain kind of pleasure in his own cottage garden, which all the princely park scenery which

he had seen and improved had failed to afford him. There is a natural pleasure in the idea of proprietorship, whether of a little garden or a widely extended domain; but the title of this article leads us to give prominence to another kind of delight—one purely mental, caused by material objects, but having no interested connexion with matter. And if the enjoyment conferred by a garden which a person can call his own be of a high nature, surely that which results from the contemplation of scenery that appears to be continuous, unbroken, infinite, (using this last word in an imaginary sense)—and thus ideally the property of none but Him whose works are characterised by unity of design and harmoniousness of connexion—is of a nature still higher. Cowper felt in his inmost soul this high kind of enjoyment; and thus describes, in his pleasing *Task*, some of the objects which gave it rise:—

> Here the gray smooth trunks
> Of ash, or lime, or beech, distinctly shine
> Within the twilight of their distant shades;
> There, lost behind a rising ground, the wood
> Seems sunk, and shortened to its topmost boughs.

Farm-yard Manure and Guano compared.—The analyses which are usually given of manures convey little information to practical men. The following calculations have been made for the purpose of showing what the farmer adds to the soil in an ordinary quantity of farm-yard manure and guano—namely, in 10 tons of the former, and 4 cwt. of African guano, which is about the usual quantity applied to the soil at one time.

Farm-yard manure in 10 tons contains—

	T.	cwts.	qrs.	lbs.	T.	cwt.	qrs.	lbs.
Water,					6	10	0	0
Humus,					0	16	0	0
Organic matter,					1	12	0	0
Inorganic matter, consisting of these portions soluble in water, as—								
Potash,	0	0	2	20				
Soda,	0	0	2	0				
Lime,	0	0	0	7				
Magnesia,	0	0	0	6				
Sulphuric acid,	0	0	2	23				
Chlorine,	0	0	2	18				
Silicic acid,	0	0	0	1				
					0	2	2	19
Inorganic matter, consisting of these portions soluble in acids, as—								
Silica,	0	3	2	0				
Phosphate of lime,	0	1	1	18				
Phosphate of magnesia,	0	0	1	22				
Phosphate of iron,	0	0	3	18				
Carbonate of lime,	0	1	3	11				
Carbonate of magnesia,	0	0	0	24				
Sand,	0	11	0	0				
					0	19	1	9
Total,					10	0	0	0

To sum up the more important parts of the above calculations, in 10 tons of manure you add—

	Cwt.	qrs.	lbs.
Phosphates, or bone earth, ...	2	3	2
Alkalies, &c., ...	1	0	25
Lime and magnesia, ...	2	0	2

Together with azote in organic matter, equivalent to nearly 1 cwt. of ammoniacal salts.

Four hundredweight of African guano consist of—

Ammoniacal salts, ...	1	0	0
Alkalies, ...	0	1	16
Phosphates of lime, &c., ...	1	2	0
Water, ...	1	0	0
Earthy matter, ...	0	0	12
	4	0	0

The above are calculated from analyses given in *Liebig's Agricultural Chemistry;* from the valuable papers given in the *Journal of the Agricultural Society of England* and other publications; and any farmer can calculate how far any of his crops exhaust the soil, and by a comparison with the above he may form a tolerable idea whether he is improving or impoverishing his land.

M. B.

Gutta Percha.—The name of this substance is pure Malayan, *gutta* signifying gum, or the concreted juice of a tree, and *percha* being the name of the plant which produces it. This tree is found in many parts of the island of Singapore, and in the forest of Johas, at the extremity of the Malayan peninsula; it also probably exists in the island of Sumatra, as the native name of that island is *Pulo Percha.* It is also said to exist on the south-east coast of Borneo; and Mr Brooke, the English resident at Sarawak, asserts that it is common in the forests of that island, where it is called *Niato* by the inhabitants, though they appear to be ignorant of the properties of the juice.

The tree attains a diameter of from three to six feet, but the wood is of no value; the fruit furnishes an oil which the inhabitants mingle with their food. The abundance of this tree round Singapore is proved by the fact, that many hundred tons have been exported since 1842. The inhabitants employ such a method in collecting the gutta percha as must speedily bring about the entire destruction of the tree. Instead of piercing the bark, and gathering what exudes naturally, they cut down the tree, and, by stripping the bark entirely off, they obtain the whole of the juice, which is then left to stiffen in the air.

There appears to be three varieties,—the *gutta guek*, *gutta tubar*, and *gutta percha.*

This extraordinary substance has the property of softening when exposed to boiling water; in this state it is capable of being moulded like clay. It is also capable of combining with wax, fatty bodies, and caoutchouc: these substances considerably modify the properties of the *gutta percha;* the caoutchouc makes it more elastic, and softer.—*Annales des Sciences Naturelles*, and Hooker's *Journal of Botany*.

*Popular Papers on subjects of Natural History.**—A series of lectures under the above title, delivered to various learned and scientific societies in Dublin within the last few years, have recently been published in a very cheap form; and it is intended to lay others of a similar kind before the public, whenever they are of such a nature as to appear worthy of preservation, and adapted for the general rather than the scientific reader. Although not professing to be familiarly conversant with the details of natural history, the authors of these papers are highly competent to discuss many of the more general questions relating to it. To these, accordingly, they have confined themselves, and several of their prelections are of considerable interest. The lecture on Instinct is from the distinguished pen of the Archbishop of Dublin, Dr Whately. He was called upon to deliver a lecture on *some* point connected with natural history; and he selected, as most in accordance with his metaphysical pursuits, that point in which natural history comes in contact with the philosophy of the human mind—namely Instinct. This difficult subject he does not profess to have studied profoundly, and he occupies himself rather in proposing questions for consideration, than in answering questions himself. "At any rate," he says, "if I cannot give you satisfaction, I hope I can give you *un*satisfaction, that is, I hope I may be able to render you dissatisfied with the extent of your knowledge, by pointing out how much there is to be known, to be studied, and to be inquired into." He endeavours to show that we can neither deny reason universally and altogether to brutes, nor instinct to man,—that each possesses a share of both, though in very different proportions. If we ask, What is the difference between man and the higher brutes? he answers, that it appears to him to consist in the power of using *signs*—arbitrary signs—and employing *language as an instrument of thought.*

We are accustomed to speak of language as useful to man, to *communicate* his thoughts. I consider this as only *one* of the uses of language. That use of language which, though commonly overlooked, is the most characteristic of man, is as an instrument of thought. Man is not the only animal that can make use of language to express what is passing within his mind, and that can understand, more or less, what is so expressed by another. Some brutes can be taught to utter, and many others to understand, more or less, what is so expressed by another. Some brutes can be taught to utter, and many others to understand, more or less imperfectly,

* Dublin: James M'Glashan. 1847.

sounds expressive of certain emotions. Every one knows that the dog understands the general drift of expressions used; and parrots can be taught not only to pronounce words, but to pronounce them with some consciousness of the general meaning of what they utter. We commonly speak, indeed, of "saying so and so by rote, as a parrot;" but it is by no means true that they are quite unconscious of the meaning of the sounds. Parrots do not utter words at random, for they call for food; when displeased, scold, and use expressions in reference to particular persons which they have heard applied to them. They evidently have some notion of the general drift of many of the expressions which they use. Almost every animal which is capable of being tamed can, in some degree, use language as an indication of what passes within. But no animal has the use of language as an "instrument of thought." Man makes use of *general signs* in the application of his power of abstraction, by which he is enabled to reason; and the use of arbitrary general signs, what logicians call "common terms," with a facility of thus using abstraction at pleasure, is a characteristic of man.—(P. 13.)

The greater part of Dr Whately's lecture consists of an extract from his *Elements of Logic*, on language as an instrument of thought. We know no author that is so ready to repeat himself as the Archbishop—to fall back on all occasions on what he has formerly written; even his pulpit discourses sometimes consist, in a great measure, of extracts from his printed works. The same thing was remarkable in Dr Chalmers. It cannot be ascribed, therefore, to penury of thought; does it arise from impatience at treading again the same path, or attempting anew what they are conscious of having already done so well? We should be unwilling to ascribe it to indolence: want of leisure may have much to do with it; for such names must produce nothing which will not bear the strictest scrutiny, and the calls upon them are often numerous and urgent.

The most interesting and amusing of these lectures is on the *Intellectuality of Domestic Animals*, by the late Rev. Cæsar Otway. He considers that, as we find in animals an adaptation of plans to circumstances, an exercise of individual judgment, reflection, induction, and memory, we must admit that an animal has independent mental powers, which, if we do not call it reason, is yet akin to it; and this he names intellectuality. He has brought together many curious anecdotes illustrative of this position, which he relates with much humour. Prepared as we are for all absurd and antediluvian notions prevailing in the remote rural districts of Ireland, we could hardly fancy that the following barbarity was still practised. "The following," says the author, "is part of a letter I received yesterday"—

The good old custom of harrowing by the tail is still followed in Erris. In justice to those who continue the practice, it is said that it is not cruel, for the horses submit to it quietly. Indeed, some people here assert that it is the most humane way doing of the work; in proof of which I shall sketch the following anecdote:—I was on my way to dine with a worthy old *gentleman* who resided here on my first arrival, nineteen years ago; and observing, as I went through the farm, this practice, it was natural for a foreigner to express strongly his feelings on the barbarity of the thing. "I beg your pardon," said my host, "you are quite mistaken; for I assert, and feel assured that you will agree with me in opinion, that it is the most humane way of working the beast; and for this reason, that he harrows with more ease to himself." "Impossible!" said I. "I will prove it to a sailor as you are, with ease," replied the old gentleman. "Pray, when you anchor your ships, why do you give them a long

scope of cable when it blows hard?"—"Because," said I, "the hold the anchor has of the ground is in an inverse ratio to the sine of the angle the cable makes with the ground." "Oh," said my old friend, "being neither an Orangeman nor Ribbonman, I know nothing about your *signs*, though I guess at what you mean. Now, if you give a long scope of cable to increase the resistance, don't it stand to reason that a short scope must have a contrary effect; and, therefore, must not harrowing by the tail be easier to the animal than from the collar, inasmuch as, in the latter case, the harrow rope is shortened by the whole length of the horse?" My host, chuckling with delight, seemed to consider this argument as a floorer; and my "But, dear sir, there is a vast difference between securing a cable to the bolt, and making it fast to the rudder-pintles," neither diminished his glee nor induced him to change his opinion. He continued this practice to his dying day; and up to last year it was, and now, 1840, it will be practised. It is hard to break a custom attended with no expense. "Of what use is a tail," says the Erris man, "if not to save all kinds of harness?"—(P. 26.)

The work is full of interesting anecdotes, some of which have found their way into the newspapers. The author concludes with the observation—that man has not yet fulfilled his duties even towards the animals he has contrived to domesticate; that, in all his improvements, he has advanced but little in the *morale* of treating inferior animals; and that much has to be learned and practised that may be conducive to *our* use and their happiness.

The other two lectures, which are well worthy of perusal, are entitled "Zoology and civilisation," and "Our fellow-lodgers;" the former by Isaac Butt, LL.D., the latter by the Rev. R. Walsh, LL.D.

*Brabazon on the Deep-Sea and Coast Fisheries of Ireland.**—As often as the Irish peasantry have been told of their imaginary hereditary bondage, have they been admonished that it is by their own hands that they must achieve their freedom. How much more important for them if they could be impressed with the fact, that hunger and nakedness—alas! no ideal calamities—would be most speedily removed by their own strenuous exertions, by acquiring habits of foresight and industry, instead of looking for relief from external liberality and the most delusive political nostrums! Nature has done much for them, if they would but do something more for themselves, and profit by her bounty. Many of the natural resources of Ireland are not only not exhausted, but they are almost inexhaustible; not a few of them are left altogether untouched. If not quite in this condition, still nearly so are the fisheries, particularly those of the deep sea. The object of the present work is to draw attention to the subject, and point out the means by which deep-sea fishing may be most successfully carried on, and those of the coast extended and improved. The instructions are clear and satisfactory, and are rendered intelligible to every one by a series of etched illustrations, on a pretty large scale, executed with much artistical skill. We cannot afford room to give an analysis of this

* *The Deep Sea and Coast Fisheries of Ireland, with Suggestions for the working of a Fishing Company.* By Wallop Brabazon, Esq. Illustrated by W. Cooper, Esq. Dublin: M'Glashan. 1848.

useful work; but it appears to us particularly well fitted to promote the patriotic object of its author. It may likewise be of advantage to the inhabitants of the north-western coasts of Scotland, to whose attention we recommend it, as they are much behind in this important branch of national industry.

*Youatt on the Pig.**—We have formerly had occasion to speak in terms of high approbation of the writings of Mr Youatt on various subjects of importance to the farmer. He has published treatises on nearly all our domesticated animals, and these have not only been distinguished for an intimate acquaintance with the general history of the respective kinds, but are calculated to be eminently useful for the instruction they supply as to the best mode of medical treatment when in a state of disease. To this department of the subject, Mr Youatt's professional avocations led him to pay particular attention, and we imagine that a safer or more intelligent guide cannot well be followed. The works he has laid before the public contain the sum of his experience, to which, alas! no further additions can now be made. Even the present work is posthumous, but as the MS. was left in a very complete state, and has undergone a careful supervision, it has suffered little or nothing from that cause. "The Horse," "Cattle," "Sheep," "The Dog," "The Pig," and a few other subjects of minor importance, have been respectively treated of in separate volumes; and we know of few works that could form a more useful and instructive addition to the farmer's book-shelves.

Notwithstanding the great utility of the pig, it has been much more neglected than most of our other domestic animals. Its instinctive propensities have been little regarded, and scarcely any approved methods of treatment ascertained, when it is attacked with disease. In fact, if a sty, no matter how dirty, and abundance of provision, no matter how coarse, be afforded, the pig is thought to be sufficiently well cared for. Yet those who have been more attentive to the animal discover in it, they imagine, many good and even amiable qualities, which, under due management, might be so developed as to confer on it even a greater degree of interest than arises from considering it merely as a mass of living pork.

The natural history of the hog (a term, we may mention, which, in all probability, means, *having narrow eyes*) is somewhat curious. It seems, in some respects, to form a kind of intermediate link between the whole-footed and cloven-footed animals, and, in others, to occupy the same ground between the cloven-footed and the digitative. It is a perfect example of a cosmopolite animal, for there is scarcely a climate capable of sustaining animal life to which

* *The Pig: a Treatise on the Breeds, Management, Feeding, and Medical Treatment of Swine; with Directions for Salting Pork and Curing Bacon and Hams.* By W. Youatt, V.S. Illustrated with engravings drawn from life, by William Harvey, Esq. London: Cradock & Co. 1847.

it will not adapt itself. It is the most prolific of all our larger sized domestic animals; indeed it is by far the most prolific quadruped of its size with which we are acquainted. Its derivation from the wild boar is unquestionable, notwithstanding all the variations it has undergone.

It also appears to have been known, and its flesh used for food, as far back as the records of history carry us. 1490 years before Christ, it must have been a prevailing food among the Israelites, otherwise there would have been no occasion for such stringent prohibitions against its use in the laws of Moses. The Romans paid particular attention to the rearing and feeding of swine; and this branch of domestic economy or luxury they designated by the word *Porculatio*. To impart a delicate flavour to the flesh, singular, and often revoltingly cruel methods were adopted. They were sometimes fed on dried figs, and drenched to repletion with honeyed wine, in order to produce a diseased and monstrous-sized liver. "The *Porcus Trojanus*, so called in allusion to the Trojan horse, was a very celebrated dish, and one that eventually became so extravagantly expensive, that a sumptuary law was passed respecting it. This dish consisted in a whole hog, with the entrails drawn out, and the inside stuffed with thrushes, larks, beccaficoes, oysters, nightingales, and delicacies of every kind, and the whole bathed in wine and rich gravies. Another great dish was a hog served whole, the one side roasted and the other boiled."—~~(P. 4.)~~ In our own country, the keeping of large herds of swine can be traced back to 863 years before Christ; and it is alleged, that about that time the warm springs at Bath were discovered by some pigs delighting to wallow in the mud produced by these springs. At a later period, immense quantities were fed in the extensive forests that then covered a considerable portion of England, in the method still practised on the Continent, where the herd is assembled every morning under the direction of the *schwein-general.*

With the general notions entertained respecting the habits of swine, it may occasion some surprise to be told that naturally they are very cleanly and sensitive animals. Modern authors are disposed to confirm what is quaintly said of them by an old author:—

"The hog, tho' he tumble in the dirte in the summer, is not a filthie animal. He doeth it, partlie to cool himselfe, partlie to kill his lice; for when the dirte is dry he rubbeth it off, and therebie destroyeth the lice."—He is fond of a good cleanly bed, (says Mr Youatt,) and often, when this is not provided for him, it is curious to see the degree of sagacity with which he will forage for himself. "A hog is the cleanliest of all creatures, * and will never dung or stale in his sty if he can get forth," says a

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* This may be truly said to be *going the whole hog*,—a proverb we the more willingly quote for the purpose of adding the only explanation we ever heard attempted of it. It has been stated above, that a favourite dish among the Romans was an entire hog, one half roasted, the other boiled. "It is not impossible that the practice of roasting the hog in an entire state gave rise to this well-known proverb." The conjecture is Mr Richardson's, the author of the little work afterwards noticed.—Ed.

quaint old writer of the sixteenth century; and we are very much of his opinion. But it is so much the habit to believe that this animal may be kept in any state of filth and neglect, that "pig" and "pig-sty" are terms usually regarded as synonymous with all that is dirty and disgusting. May not his rolling in the mud—a habit he has in common with the other *Pachydermata*—be for the purpose of cooling himself, and keeping off the flies? Savages cover themselves with grease in hot climates in order to protect their skins; may not instinct teach animals to roll themselves in mud for a similar purpose.—(P. 23.)

According to Linnæus, the hog is more nice in the selection of his vegetable diet than any of the other of our domesticated herbivorous animals. If the following table could be relied upon as at all accurate, it would afford very curious inferences:—

The Cow	eats 276	plants,	and rejects	218
... Goat	... 449	...	...	126
... Sheep	... 387	...	...	141
... Horse	... 262	...	...	212
... Hog only	... 72	...	...	171

Although the wild boar is confined to the old world, the races derived from it have been long abundant in America, having been carried thither by the earlier navigators, and industriously propagated by the British settlers. American zoologists describe no fewer than six species of hog, so distinct in their general habits and appearance that they never breed or associate with each other. The common hog is often kept in the woods, where it feeds on chestnuts and apples; and, in order to fatten it for the butcher, it is common to give large quantities of Indian meal, as well as steamed food. In South Carolina, where the climate is very mild, they are allowed to wander about the woods the whole year, feeding on nuts, acorns, &c. They are likewise said to destroy snakes. In some of the towns they are so abundant as to prove almost a nuisance:—

I am sure I should have liked Cincinnati much better, (piteously exclaims Mrs Trollope,) if the people had not dealt so largely in hogs! The immense quantity of business done in this line would hardly be believed by those who had not witnessed it. I never saw a newspaper without remarking such advertisements as the following:—"Wanted immediately, 4000 fat hogs;" "For sale, 2000 barrels of prime pork." But the annoyance came nearer than this. If I determined upon a walk up Main Street, the chances were five hundred to one against my reaching the shady side without brushing by a snout or two, fresh dripping from the kennel. When we had screwed up our courage to the enterprise of mounting a certain noble-looking sugar-loaf hill, that promised pure air and a fine view, we found the brook we had to cross at its foot red with the blood from a pig slaughter-house; while our noses, instead of meeting the thyme that loves the green hill's breast, were greeted by odours that I will not describe, and which I heartily hope my readers cannot imagine; our feet, that on leaving the city expected to press the flowery sod, literally got entangled in pigs' tails and jaw bones; and thus the prettiest walk in the neighbourhood was interdicted for ever.

The original breed of the country is now crossed with the Chinese and Berkshire breeds, and the present stock is much esteemed.

In the southern countries of Europe, swine are frequently found almost free from bristles of any kind, the skin being nearly smooth. Such is the small black Maltese breed, which fattens readily, and

affords most delicate pork. The far-famed Bologna sausages are made from the flesh of a Spanish breed, which is found in many parts of the south of Italy. Almost every county of England has, as is well known, its peculiar breed, and nearly all of them are celebrated for certain good qualities. These will be found described at length in Mr Youatt's work.

The author describes the anatomy of the pig, and gives a very full account of the various diseases to which it is liable, together with the remedies by which they are most likely to be removed. He then treats of the best modes of feeding and fattening, the proper construction of piggeries, killing of pigs, curing of bacon, &c. Nothing, in short, is omitted likely to be of use to those who take an interest in the "swinish multitude;" and the treatise may be safely recommended as the most useful and comprehensive that has yet appeared on this subject.

Richardson on Pigs, the Hive-Bee, and the Pests of the Farm.*— These are part of a series of little works on our domesticated animals, by the same author, which, from their useful tendency and low price, have, we believe, been pretty widely circulated. In the number referred to below, the author goes over nearly the same ground as Mr Youatt, but, of course, the limits of his work do not admit of his entering so much into detail. The author is right in conjecturing that few could peruse his work without being convinced that he had borrowed from Mr Youatt on many occasions without acknowledgment. Much of the general matter is similar, the quotations often the same, and many of the expressions identical, even when these happen to be not the most obvious and natural. But this, as will be seen by Mr Richardson's statement, is only another of those curious coincidences which so often occur.

Subsequent to the announcement of this volume, and while it was actually in the printer's hands, a work on the same subject, by the able pen of the late Mr Youatt, has issued from the press. The author has read Mr Youatt's work, and has felt so much struck with the similarity which, in many of its details, it bears to his own, that he deems it due to himself to make this statement, lest, from the trifling priority in the appearance of that work in the literary market, he might, by unreflecting persons, be held guilty of plagiarism. He has only to add that, such has not only not occurred, but that circumstances rendered any such attempt, even had he desired in any respect avail himself of Mr Youatt's labours, absolutely impossible.†—(*Pref.* p. 1.)

[illegible] information respecting the mode of killing, salting, and preserving the flesh of hogs as practised in Ireland, will be found in this little work [illegible] supplies [illegible] individuals of practical know-

* *Pigs, their Origin and Varieties, Management with a view to Profit and Treatment under Disease; also, Plain Directions relative to the most approved modes of curing and preserving their flesh.* By H. D. RICHARDSON. Dublin: M'Glashan. 1847.

† Mr Richardson states that Mr Youatt's work on swine had not appeared when his volume was in the printer's hands, and yet he refers to it in his notes. (See page 18.) This we do not comprehend.—Ed.

ledge and long experience. The following is the author's account of the old greyhound pig, along with some general remarks on the keeping of pigs in Ireland:—

These are tall, long-legged, bony, heavy-eared, coarse-haired animals, their throats furnished with pendulous wattles, called in Irish *sluiddeen*, and by no means possessing half so much the appearance of domestic swine as they do of the wild boar, the great original of the race. In Ireland the old gaunt race of hogs has, for many years past, been gradually wearing away, and is now perhaps wholly confined to the western parts of that country, especially Galway. These swine are remarkably active, and will clear a five-barred gate as well as any hunter; on this account they should, if it be desirable to keep them, be kept in well-fenced enclosures. The breed of pigs in Ireland has improved greatly of late years, and this, the old unprofitable stock, is rapidly disappearing. The form of the Irish pig is now so nearly approximated to that of the English, that the two animals are not readily distinguished from each other. Now, indeed, I regret to have to state that there can be little danger of mistake, the failure of the potato crop having not merely deprived the wretched people of their staple, nay, in many instances, probably in a great majority of such, only sustenance, but deprived them of the means of feeding swine. When the people *could* keep these animals, they found them very profitable stock, The hog was, indeed, regarded by the Irish peasant with a peculiar degree of affection and kindness; he shared with his owner not merely the shelter of his cabin, and the provisions of the children, but the warmest place at the fireside. "The pig, the cratur," was second in importance and consideration to no inmate of the tenement he honoured with his presence; and richly too he merited the high degree of estimation in which he was held, for he did that which in many cases his poverty-ground proprietor could not have done without his aid—*he paid the rent*. The pig can now no longer find a home in the Irish cabin; the means of feeding him are departed; hopeless hunger and perishing want now occupy his post at what was once the fireside; the potato and the pig have disappeared, and their loss has increased the poverty of an already penury-stricken people a hundredfold. Nor is it the pauper peasant alone who can no longer speculate in swine; the evil day has not been partial, but all classès have proportionately felt its blighting influence; the more extensive breeders find that their stocks will not pay their keep, and they are accordingly shipping them off for England in multitudes, while the gaunt forms and drawn-up bellies of the half-famished animals, with their semi-wolfish eyes, tell too plainly of the failure of their wonted nourishment.—(P. 31.)

Of the other two of Mr Richardson's neat little volumes, the *Hive-bee*, and the *Pests of the Farm*, the former contains very useful directions for bee-culture, a department of rural industry in which most of our cottagers are still much behind, notwithstanding all that has been done of late to induce them to follow an improved mode of treatment. Surely such considerations as the following ought not to be without influence, although we are inclined to think that the author is somewhat too sanguine, and makes too little allowance for the numerous casualties to which bees are liable:—

It is not my intention, (he says,) to exhibit the advantages of keeping bees on old and erroneous, and, I wish I could add, *exploded* systems of management; but to show what can be done, if done *correctly*. I shall say nothing, therefore, as to what may be done with the common old hives, as I regard keeping bees in them, when more fitting ones may so easily be procured, as evincing something very like a self-willed determination *not* to make profit, *not* to become rich. Yes, I repeat it, bee-keeping, when conducted on a proper principle, will form no mean item in the domestic economy of an extensive agriculturist; while to the humble cottier it will prove a little fortune, and furnish the means of effectually and permanently bettering his condition. I would say that a single set of collateral boxes, so simple in its construction, and composed of such inexpensive materials that any one could make

them, ought to yield a profit of at least from £10 to £15 per annum, sufficient to pay the rent of from five to ten acres of land, by no means a despicable holding, and one which, in its turn, will become a source of comfort, of independence, of social, and consequently, of course, of *national* amelioration.—(P. 13.)

The "Pests of the Farm" are enumerated and described, and ample instructions given for guarding against them, and destroying them. The portion relating to rats and mice appears to us most satisfactory, while that referring to insects is meagre and very inaccurate.

*Paul's Rose Garden.**—Our agricultural correspondents will not now give us space to notice the practice of gardeners; but to refuse to accept, and even to speak kindly of so beautiful a book as the *Rose Garden* by Mr Paul, when presented by fair hands, were to be worse than a cynic. And truly no coaxing is required to eulogise in high terms the very beautiful work which Mr Paul has produced on so pleasant a subject as the rose, the favourite of flowers, the queen of the garden, in all its varieties and beauties. Mr Paul has not only attended to the amenities of his subject, in narrating its history, and relating much of the best inspirations of the poets, ancient and modern, in its praise, but has given minute and important details of its cultivation, in every state, within and without doors, which every rose-grower cannot do better than follow, founded as the author's advice is upon experience, and rectified by observation and good sense; and that he is competent to give such advice, we have only to mention that Mr Paul is the most successful rose-grower in England. We have not room for extracts, but may glean a few particulars regarding the otto or attar of roses—the most exquisite of all perfumes. The best otto is made at Ghazeepore in Bengal, and the variety cultivated there for its production is the musk rose. One acre contains 2000 rose trees, which yield 2 lacs of roses, during the flowering season in March and April, and whose flowers are sold for 40 to 70 rupees the lac. The otto is obtained from the rose-water which has been distilled, and 1000 roses should produce 2 lbs. troy of rose-water. The rose-water is put into metal basins, which are covered with muslin to keep out the dust and insects, and sunk 2 feet into the ground and allowed to remain all night. The otto, which appears as a film on the surface of the water in the morning, is removed by means of a feather into a phial, and, when a sufficient quantity has been procured, is poured off clean into small phials: the colour is at first a pale greenish hue, and afterwards becomes pale yellow.

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* *The Rose Garden.* By WILLIAM PAUL, of the Nurseries, Cheshunt, Herts. Sherwood, Gilbert, and Piper, London. 1848.

A lac of roses yields 180 grains of otto, and every 168 grains, or a tolah, of otto, sells for 80 or 90 rupees. But the otto is generally adulterated with sandal oil, because the richest natives will not give the price at which the purest otto can be procured—at six times its own weight of gold. The roses at Ghazeepore fetch from 15,000 to 20,000 rupees a-year, and the profits derived from the manufacture, which the growers never undertake, is estimated at about 40,000 rupees.

Preventive for the Potato Rotting.—A correspondent informs us that the plan proposed by Mr Young, the able director of Messrs Tennant, Close, and Co.'s chemical works in Manchester, to the Manchester Philosophical Society, in December 1845, called forth the opinion of the Society in the following terms, in a pamphlet published by the Directors of the Society—"The committee have immersed diseased potatoes in sulphuric acid, (oil of vitriol,) mixed with forty parts of water, and found that the disease in the potatoes so treated had not progressed." Our correspondent is assured, from excellent authority, that, as a preventive of the extension of the disease to the sound part of the tuber of the potato, this is a certain and simple remedy. We are not sure that the remedy would be practicable on an extensive scale, but perhaps as much as the seed for the next year's crop might be secured in this way.

*Bain on the Potato Disease.**—In noticing this brochure, we have no intention to deal with the general question of that mysterious malady, the disease in the potato, nor with the final conclusions at which we see its author has arrived. The general question will afford many opportunities of investigating its true origin; and although up to the present time it has assumed so many Protean shapes, yet doubtless the time will arrive when we shall be able to affix for it "a local habitation and a name." We cannot be found fault with, for any expression of caution on this subject, by the author of this work, at least, for as he has himself waited for the experience of one season before issuing his work, after being printed, we are surely at liberty to wait for another, before giving our opinion.

We can however say, without the fear of contradiction, that this essay is a very elaborate performance, and, what is better, it is very completely elaborated. Its author quarters the entire field,—will not allow himself to take up a cross-scent,—he thinks he has the game before him,—and he is determined, if possible, to secure it. His earnestness is palpable; and if he fail in his object, his disappointment will evidently be proportionably

* *Observations on the Potato Disease of* 1845 *and* 1846; *being an attempt to disclose the Causes of that Disease, and if possible the Cure.* By Donald Bain, Accountant, Edinburgh. Oliver and Boyd, Edinburgh; Simpkin and Marshall, London, 1848.

great. Whatever may be the result, the agricultural community are indebted to Mr Bain for taking the trouble of sifting the multitude of facts which have been observed and recorded by practical men on this subject, and of arranging them in a somewhat intelligible order. His labours will at least enable future reasoners to refer more easily to existing facts, and render his work valuable as one of reference. It will be much more satisfactory to the reader to peruse the work himself, than receive an imperfect analysis of it from us; and therefore, without entering into particulars, we may say generally that the staple of the author's observations consist in a relation of all the phenomena of the disease, as observed by himself and others, endeavouring, as well as he can, to account for those phenomena, and if possible to obviate them; and he then occupies himself in giving proofs of the soundness of his propositions from the correspondence of practical men: thus giving himself and the reader an opportunity of again going over the ground, and bringing into connexion, and reasoning upon many detached but valuable observations, that, but for the connexion thus given, would have had every chance of escaping consideration.

On venturing to give practical directions in the culture of the potato crop, for the probable avoidance of the disease, our author never forgets that he is a non-practical man; and as it is impossible for even any practical man to say that what he suggests, different from the common practice, would be attended with no benefit, the wiser course for the cultivator will be to try his suggestions in experiment, rather than reject them without trial.

Enfield Market Cabbage.—By Mr TOWERS, Croyden.—They who propose to cultivate *cabbage* for cattle and milk cows, should prepare a seed-bed in some open spot or strip of land. The great *drum-head* is a capital variety, producing an abundance of food. It was stated by Sinclair that, for the dairy, one acre of cabbages is worth three acres of turnips; and, according to the *Book of the Farm*—vol. ii. p. 28—there is no doubt that the taste of milk is less tainted by cabbages than by turnips, and that more milk can probably be derived from them. This is doubted by some, and therefore it is for *bulk of food* for oxen that I would recommend cabbage as a crop of the farm. Mr Sinclair said—"if planted in drills, as for turnips, in good soil, 18 inches asunder, an acre will give 12,907 plants,—and at 24 inches apart, 9834 plants; and if they all attain the weight that cabbages sometimes do, that is from 18 lb. to 23 lb. each, the lowest number (18 lb.) will give a crop of 78 tons." There is a cabbage—not so large, indeed, but most excellent for field or garden, and so hardy that I saw no injury done to the smallest seedling by the severe and protracted frost of 1846-7: it was sent to me under the name of the "Enfield Market Cabbage." If true to its kind, and planted out by September in deep, loamy, manured land, the yield would be ample and very valuable.

TABLE OF PRICES, &c.

The Average Price of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1848.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
June 3.	50 4	34 2	22 1	29 6	40 7	35 1
10.	50 3	33 5	21 1	29 10	39 8	34 9
17.	48 3	32 7	22 1	30 2	39 3	34 10
24.	48 11	33 3	21 8	30 0	37 5	34 2
July 1.	51 7	36 5	22 3	30 0	38 4	33 3
8.	50 11	31 11	20 10	29 0	38 3	33 0
15.	52 8	31 4	21 6	29 2	38 3	34 7
22.	52 9	30 9	19 10	31 0	36 0	32 1
29.	50 9	25 3	20 6	30 0	37 1	35 3
Aug. 5.	52 9	30 0	22 7	28 6	36 6	32 6
12.	55 11	25 0	22 3	26 0	37 0	31 10
19.	55 0	31 6	22 7	31 10	37 7	33 3
26.	55 11	32 0	21 10	30 4	39 8	35 9

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1848.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
June 3.	49 5	34 7	20 9	29 6	36 6	34 9
10.	49 4	34 2	20 1	30 2	37 4	33 7
17.	49 7	32 4	20 8	30 0	37 10	32 2
24.	47 6	28 7	19 10	29 4	38 2	33 10
July 1.	48 7	30 6	19 4	29 6	37 8	34 8
8.	50 7	31 2	19 10	28 8	37 2	34 0
15.	48 10	30 9	18 6	27 5	36 9	34 8
22.	49 10	30 2	20 2	28 9	37 3	36 6
29.	51 10	29 8	20 0	29 2	36 8	37 11
Aug. 5.	52 1	28 9	21 3	29 10	35 6	37 3
12.	55 5	27 11	22 2	30 4	35 11	36 0
19.	55 9	28 2	22 6	30 10	36 2	41 5
26.	56 0	32 4	23 5	30 6	35 9	37 0

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1848.	s. d.	s. d.	s. d.	s. d.	s. d.
June 7.	53 9	34 3	23 8	34 6	35 2
14.	55 10	33 11	24 4	33 10	34 4
21.	53 11	35 2	23 1	33 8	34 3
28.	53 0	32 10	21 10	33 4	33 10
July 5.	53 6	33 10	21 8	33 5	33 11
12.	54 8	33 0	22 7	33 9	34 3
19.	55 0	32 8	23 4	34 6	35 3
26.	56 10	30 9	24 0	36 0	36 9
Aug. 2.	59 0	35 3	25 9	37 0	37 8
9.	59 2	32 5	25 5	36 2	36 8
16.	61 2	33 0	25 7	36 4	36 9
23.	64 6	33 10	25 10	37 4	37 10
30.	62 3	35 0	27 8	40 6	41 8

DUBLIN.

Date.	Wheat, p. barl. 20 st.	Barley, p. barl. 16 st.	Bere, p. barl. 17 st.	Oats, p. barl. 14 st.	Flour, p. barl. 9 st.
1848.	s. d.	s. d.	s. d.	s. d.	s. d.
June 2.	30 5	16 3	11 2	12 11	16 0
9.	28 8	16 6	10 9	12 2	16 2
16.	29 6	16 8	10 6	11 11	16 1
23.	29 4	16 2	10 8	11 9	16 0
30.	27 8	16 0	11 6	11 8	16 6
July 7.	30 4	16 4	12 0	11 11	17 6
14.	31 0	16 6	11 8	12 2	17 9
21.	31 6	15 6	11 6	12 5	17 9
28.	32 5	17 9	11 7	12 11	17 11
Aug. 4.	33 8	14 3	11 8	13 6	17 11
11.	33 9	15 2	11 9	13 7	17 8
18.	33 6	15 6	12 3	14 5	17 6
25.	33 11	15 9	12 8	14 7	17 8

TABLE showing the Weekly Average Price of GRAIN, made up in terms of 7th and 8th Geo. IV., c. and 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties payable on FOREI(CORN: the Duties payable thereon, from June 1848 to September 1848.

Date.	Wheat. Weekly Average.	Wheat. Aggregate Average.	Wheat. Duty.	Barley. Weekly Average.	Barley. Aggregate Average.	Barley. Duty.	Oats. Weekly Average.	Oats. Aggregate Average.	Oats. Duty.
1848.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
June 3.	48 1	48 11	8 0	31 8	32 4	2 0	21 0	20 3	2 6
10.	47 8	48 7	9 0	31 7	32 3	2 0	20 9	20 5	2 6
17.	46 10	48 1	9 0	30 10	32 0	2 0	20 8	20 7	2 6
24.	46 11	47 7	10 0	31 2	31 9	2 0	20 9	20 8	2 6
July 1.	48 2	47 8	10 0	30 5	31 5	2 0	20 10	20 9	2 6
8.	48 10	47 9	10 0	30 1	30 11	2 6	20 8	20 9	2 6
15.	49 1	47 11	10 0	29 0	30 6	2 6	20 9	20 9	2 6
22.	48 11	48 2	9 0	30 2	30 6	2 6	20 3	20 8	2 6
29.	47 11	48 4	9 0	29 5	30 1	2 6	20 7	20 8	2 6
Aug. 5.	49 5	48 9	9 0	29 11	29 10	3 0	21 0	20 6	2 6
12.	50 11	49 2	8 0	30 1	29 9	3 0	21 8	20 10	2 6
19.	51 0	49 6	8 0	30 3	29 10	3 0	21 5	20 11	2 6
26.	52 3	50 1	7 0	31 2	30 2	2 6	21 11	21 2	2 0

Date.	Rye. Weekly Average.	Rye. Aggregate Average.	Rye. Duty.	Pease. Weekly Average.	Pease. Aggregate Average.	Pease. Duty.	Beans. Weekly Average.	Beans. Aggregate Average.	Beans. Duty.
1848.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s.
June 3.	35 8	29 10	2 0	38 0	36 8	2 0	37 10	36 1	2
10.	28 0	29 9	2 0	37 0	36 7	2 0	38 4	36 8	2
17.	31 7	29 8	2 0	38 0	36 11	2 0	37 8	37 1	2
24.	29 4	29 7	2 0	38 4	37 4	2 0	36 11	37 3	2
July 1.	30 2	29 9	2 0	38 2	37 9	2 0	36 8	37 4	2
8.	31 0	30 2	2 6	37 4	37 10	2 6	36 7	37 3	2
15.	31 2	30 4	2 6	37 3	37 8	2 6	36 6	37 2	2
22.	28 3	30 3	2 6	36 3	37 7	2 6	35 11	36 9	2
29.	30 2	30 0	2 6	36 1	37 3	2 6	35 9	36 5	2
Aug. 5.	29 4	30 0	3 0	34 8	36 8	3 0	35 3	36 2	3
12.	29 7	29 11	3 0	35 2	36 1	3 0	36 0	36 0	3
19.	31 11	30 1	3 0	36 3	35 11	3 0	37 9	36 2	3
26.	30 10	30 0	2 6	38 1	36 5	2 6	37 7	36 0	2

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Date.	Markets.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
1848.		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
June	Danzig	35 to	42	16 6	22 6	12 9	16 6	18 6	22	24	29	22 6	27
July	do.	36 6	42 6	18	22 6	13 6	17 6	20	24	26	30	24	28 6
August	do.	38	46 6	20	25 6	14 6	18 6	21 6	25 6	25	30	22 6	27
June	Hamburg	34	40 6	17 6	22 9	13 6	16 6	20	26 6	25 6	31	24 6	28 6
July	do.	35 6	42	18 6	25 6	13 6	18	22	28	24 6	28 6	26 6	28
August	do.	40 6	45 6	20 6	26 6	14 6	19 6	22	29	24	27	23 6	27 6
June	Bremen	34 6	41 6	16 6	22	12 6	16	16 6	22	24 6	30	22 6	26 6
July	do.	37 6	44	17	23 6	13 6	17 6	18 6	26	25	31 6	24	28 6
August	do.	40 6	47	18 6	24	13 6	19 6	27	29 6	26	32	25	30
June	Königsberg	34	38 6	16 6	24	13 6	17 6	18 6	22 6	26	32	22	27 6
July	do.	36 6	42 6	15 6	22 6	14 6	18 6	20	24	24	30	23	28 6
August	do.	38 6	47	18	25	15	20	18	21 6	25	32	24 6	31

Freights from the Baltic were from 4s. to 6s. 6d., and from the Mediterranean, 6s. 6d. to 11s. per imperial quarter.

THE REVENUE,
From 5th July 1847 to 5th July 1848.

	Quarters ending July 5.		Increase.	Decrease.	Years ending July 5.		Increase.	Decrease.
	1847.	1848.			1847.	1848.		
	£	£	£	£	£	£	£	£
Customs	4,519,119	4,447,832	..	71,287	18,792,348	17,888,988	..	903,360
Excise	3,291,052	3,473,803	182,751	..	12,733,988	12,263,233	..	470,765
Stamps	1,869,464	1,557,640	..	311,824	7,201,797	6,449,108	..	752,689
Taxes	2,075,001	2,034,133	..	40,868	4,325,732	4,306,703	..	19,029
Post-Office	215,000	136,000	..	79,000	854,000	787,000	..	67,000
Miscellaneous	7,461	99,022	91,561	..	419,621	301,201	..	118,420
Property Tax	1,036,517	988,401	..	48,116	5,491,936	5,411,253	..	80,683
	13,013,614	12,736,831	274,312	551,095	49,819,422	47,407,486	..	2,411,946
	Deduct Increase			274,312				
	Decrease on the qr.			276,783	Decrease on the year			2,411,946

TABLES OF BUTCHER-MEAT.

Date.	LONDON. Per Stone of 14 lbs.				LIVERPOOL. Per Stone of 14 lbs.				NEWCASTLE. Per Stone of 14 lbs.				EDINBURGH. Per Stone of 14 lbs.				GLASGOW. Per Stone of 14 lbs.		
	Beef.		Mutton.		Beef.		Mutton.		Beef.		Mutton.		Beef.		Mutton.		Beef.		Mutton.
1848.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s.d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
June	6 6 to	7 6	7 6 to	8 9	6 to	7 3	7 6 to	8 6	6 3 to	7 6	7 6 to	8 6	5 6 to	7 3	6 6 to	7 9	6 9 to	7 6	7 6 to
July	6 6	7 6	7 9	8 9	6 6	7 6	7 6	8 6	6 3	7 3	6 9	8 2	5 9	7 6	6 6	7 9	6 9	7 9	7 6
August	6 3	7 3	7 6	8 6	6 3	7 3	6 6	7 6	6	7 3	6 6	8 0	6	7 3	6 3	7 6	6 6	7 6	7 3

[illegible] WOOL.

[illegible] per 14 lbs.

			s. d.	s. d.
[illegible]		[illegible] Hogg	9 6 to	12
[illegible]		Ewe and Hogg, ...	8	10
[illegible]h Down.	[illegible]	[illegible]iot, white, ...	7	[illegible] 6
Half-Bred,.	[illegible]	[illegible]aid, washed, ...	5	[illegible] 6
[illegible]cester Hog.	[illegible]	[illegible]washed, ...	4	7
[illegible]		[illegible]white, ...	4 [illegible]	[illegible] 6
[illegible]		[illegible]aid, washed, ...	3 [illegible]	4 9
[illegible]		[illegible]washed	[illegible]	[illegible]

THE USE OF LIME IN AGRICULTURE.

No. V.

By Professor Johnston.

THE theory of the action of lime upon the land has occupied much attention among practical men in various countries. It may still be difficult to clear up every fact regarding it in a satisfactory manner. Yet in the following sections I hope to present such an explanation of the mode in which it acts, and of the chemical principles by which its action is regulated, as shall be both intelligible to the ordinary reader, and generally satisfactory to all.

Section I.—*General action of Lime as a chemical constituent of the Soil.*

Lime, as I have already shown, acts in two ways upon the soil. It produces a *mechanical* alteration, which is simple and easily understood, and is the cause of a series of *chemical* changes, which are really obscure, and are as yet susceptible of only partial explanation.

In the finely-divided state of quick-lime, of slaked lime, or of soft and crumbling chalk, it stiffens very loose soils, and opens the stiffer clays; while, in the form of limestone gravel or of shell-sand, it may be employed either for opening a clay soil or for giving body and firmness to boggy land. These effects, and their explanation, are so obvious that it is unnecessary to dwell upon them more than has already been done.

The purposes served by lime as a chemical constituent of the soil are at least of four distinct kinds.

1°. In every state of chemical combination it supplies one or more kinds of inorganic food, which appear to be necessary to the healthy growth of all our cultivated plants.

2°. In the state of quick-lime or of carbonate it performs three additional functions.

a. It neutralises acid substances which are naturally formed in in the soil, and decomposes other noxious compounds which are not unfrequently within reach of the roots of plants, producing in their stead substances which are not only harmless but often directly useful to vegetation.

b. It changes the inert vegetable matter in the soil, liberates the inorganic substances it contains, and thus gradually renders it useful to vegetation.

c. It aids and promotes the decomposition of the mineral or rocky fragments of which so much of all our soils consists, sets free the mineral substances they contain, and thus enables them to become useful to the growth of plants.

These several modes of action it will be necessary to illustrate in some detail.

SECTION II.—*Of Lime as the food of plants.*

On examining the chemical nature of the ash of plants, it is found that lime in all cases forms a considerable proportion of its whole weight. Hence the reason why lime is regarded as a necessary food of plants, and hence also one cause of its beneficial influence in general agricultural practice.

The quantity of pure lime contained in the crops produced upon one acre, during a four years' rotation, amounts, on an average, to about 200 lbs., equal to 360 lbs. (say 3½ cwt.) of carbonate of lime, in the state of marl, shell-sand, or limestone gravel. It is obvious, therefore, that one of the most intelligible purposes served by lime, as a chemical constituent of the soil, is to supply this comparatively large quantity of lime, which, in some form or other, must enter into the roots of plants.

But the different crops which we grow contain lime in unlike proportions. Thus the average produce of an acre of land under the following crops contains of lime—

		Lime in the		
	Per Acre.	Grain.	Straw or roots.	Total.
Wheat, . .	(25 bush.)	1	12	13 lbs.
Barley, . .	(40 bush.)	1¼	15¼	17 lbs.
Oats, . .	(50 bush.)	3	19	22 lbs.
Rye, . . .	(26 bush.)	1½	15½	17 lbs.
Beans, . .	(25 bush.)	2½	34	36½ lbs.
Turnips, . .	(20 tons.)	46	72	118 lbs.
Potatoes, . .	(8 tons.)	8	31	39 lbs.
Red clover, . .	(2 tons.)	—	77	77 lbs.
Rye grass, . .	(2 tons.)	—	30	30 lbs.

These quantities are not constant, and generally all our crops contain more lime when grown upon land to which lime has been copiously applied. But the very different quantities contained in the several crops, as above exhibited, show that one reason *why lime favours the growth of some crops more than others* is, that some actually take up a larger quantity of lime as food. These crops, therefore, require the presence of lime in greater proportion in the soil, in order that they may be able to obtain it so readily that no delay may occur in the performance of those functions, or in the growth of those parts, to which lime is indispensable.

SECTION III.—*Relation of the period of growth of a plant to the effect and proportion of Lime in the soil.*

In connexion with the quantities of lime actually found in plants, another important circumstance must be taken into consideration.

Whatever kind or amount of food a plant may require to bring

it to maturity, it must collect the whole during the time usually allotted to its growth. Thus the longer a crop is in the ground, —the slower it grows, and the longer it usually takes to come to maturity—the more time it has to collect its food from the soil by means of its roots. Barley germinates and ripens its seed within three months—in Sicily sometimes within three weeks—while wheat is from six to ten months in the ground. The roots of barley, therefore, must do much more work in the same time than those of wheat. They must, among other things, take up the 17 lbs. of lime in the above table in three months, while wheat takes up on an average only 13 lbs. in six months. Now, to effect this in the same soil, it must send out more roots in quest of this kind of food than the wheat plant will require to do, and thus it must waste more of its vegetative strength under ground. But if we make the supply of lime in the soil more abundant, we diminish the labour of the barley plant, and greatly facilitate its growth.

Thus we arrive at the conclusion that the proportion of lime contained in the soil ought to be adapted not only to the proportion which the perfect plant is found to contain and require, but to the period also which is allotted to its natural growth. For crops which run their course quickly, a larger proportion of lime, as well as of all other kinds of food, will be required, or will be beneficial, than for crops that are longer in coming to perfection. Has this fact any thing to do with the earlier harvests upon well-limed land, or with its peculiar fitness for the growth of barley?

SECTION IV.—*The chemical action of Lime is exerted chiefly upon the organic matter of the soil.*

There are four circumstances of great practical importance which cannot be too carefully considered in reference to the theory of the operation of lime. These are—

1°. That lime, unless in the form of compost, has comparatively little or no effect upon soils in which organic matter is deficient.

2°. That its apparent effect, at least upon the corn crop, is inconsiderable during the first year after its application, compared with that which it produces in the second and third years.

3°. That its effect is most sensible when it is kept near the surface of the soil, and gradually becomes less as it sinks towards the subsoil. And

4°. That, under the influence of lime, the organic matter of the soil disappears more rapidly than it otherwise would do, and that, after it has thus disappeared, equal additions of lime are much less beneficial than before.

It is obvious, from these facts, that *in general* the main beneficial purpose served by lime is to be sought for in the nature of its chemical action upon the organic matter of the soil—an action

which takes place slowly, which is hastened by the access of air, and which causes the organic matter itself ultimately to disappear.

SECTION V.—*Of the forms in which organic matter usually exists in the soil.*

The organic matter which lime thus causes to disappear is presented to it in one or other of five different forms:—

1°. In that of recent, often green, moist, and undecomposed roots, leaves, and stems of plants.

2°. In that of dry and still undecomposed vegetable matter, such as straw.

3°. In a more or less decayed or decaying state, generally black or brown in colour, and often in some degree soluble in water. In such a state we see it in peat.

4°. In what is called the *inert* state, when spontaneous decay ceases to be sensibly observed. And—

5°. In the state of chemical combination with the earthy substances, forming humates, ulmates, &c. with the alumina, and with the lime or magnesia which exist in the soil.

Upon these several varieties of organic matter lime acts with different degrees of rapidity.

SECTION VI.—*Circumstances under which the decomposition of the organic matter may take place.*

The final result of the decomposition of these several forms of organic matter, when they contain no nitrogen, is their conversion into carbonic acid and water only. They pass, however, through several intermediate stages before they reach this point—the number and rapidity of which, and the kind of changes they undergo, at each stage, depend upon the circumstances under which the decomposition is effected. Thus the substance may decompose—

1°. *Alone*, in which case the changes that occur proceed slowly, and arise solely from a new arrangement of its own particles. This kind of decomposition rarely occurs to any extent in the soil, and then only in such as are very compact, and impervious to air and water.

2°. *In the presence of water only.*—This also seldom takes place in the soil. Trees, long buried in moist clays impervious to air, exhibit the kind of slow alteration which results from the presence of water alone. In the bottoms of lakes, ditches, and boggy places also, from which inflammable gases arise, water is the *principal* cause of the more rapid decomposition.

3°. *In the presence of air only.*—In nature, organic matter is never placed in this condition, the air of our atmosphere being always largely mixed with moisture. In dry air, decomposition is

exceedingly slow, and the changes which dry organic substances undergo in it are often scarcely perceptible.

4°. *In the presence of both water and air.*—This is the almost universal condition of the organic matter in our fields and farm-yards. The joint action of air and water, and the tendency of the elements of the organic matter to enter into new combinations, cause new chemical changes to succeed each other with much rapidity. It will, of course, be understood that moderate warmth is necessary to the production of these effects.*

5°. *In the presence of lime*, or of some other alcaline substance, (potash, soda, or magnesia).—Organic matter is often found in the soil in such a state, that the conjoined action of both air and water are unable, without other aid, to hasten its decomposition. A new chemical agency must then be introduced, by which the elements of the organic matter may again be set in motion. Wood-ashes, kelp, carbonate of soda, &c., act in this way; but lime is the agent which, for this purpose, is most largely employed in practical agriculture.

SECTION VII.—*General action of alcaline substances (potash, soda, &c.) upon organic matter.*

It is this action of alcaline matters upon the organic substances of the soil, in the presence of air and water, that we are principally to investigate.

When organic matter undergoes decay in the presence of air and water only, it first rots, as it is called, and blackens, giving off water or its elements chiefly, and forming *humus*—a mixture of humic, ulmic, and some other acids, with decaying vegetable fibre. It then commences, at the expense of the oxygen of the air and of water, to form other more soluble acids, (malic, acetic, lactic, crenic, mudesic, &c.,) among which is a portion of carbonic acid; while, by the aid of the hydrogen of the water which it decomposes, it produces also one or more of the many inflammable compounds of carbon and hydrogen, which often rise up, as marsh-gas does from stagnant pools in summer, and escape into the air.

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* A familiar illustration of the conjoined efficacy of air and water, in producing oxidation (rusting), is exhibited in their action upon iron. If a piece of polished iron be kept in perfectly dry air, it will not rust. Or if it be completely covered over with pure boiled water, in a well-stoppered bottle, from which air is excluded, it will remain bright and untarnished. But if a polished rod of iron be put into an open vessel half full of water, so that one part of its length only is under water, then the rod will begin very soon to rust at the surface of the water, and a brown ochrey ring of oxide will form around it, exactly where the air and water meet. From this point the rust will gradually spread upwards and downwards. So it is with the organic matter of the soil. Wherever the air and water meet, their decomposing action upon it, in ordinary temperatures, soon becomes perceptible.

Thus there is a tendency towards the accumulation of acid substances of vegetable origin in the soil, and this is more especially the case when the soil is moist, and where much vegetable matter abounds. The effect of this superabundance of acid matter is, on the one hand, to arrest the further natural decay of the organic matter, and on the other to render the soil unfavourable to the healthy growth of young or tender plants.

The general effect of the presence of alcaline substances in the soil is to counteract these two evils. They combine with and thus remove the sourness of the acid bodies as they are formed. In consequence of this the soil becomes *sweeter*, or more propitious to vegetation, while the natural tendency of the vegetable matter to decay is no longer arrested.

It is thus clear that an immediate good effect upon the land must follow either from the artificial application, or from the natural presence, of alcaline matter in the soil—while at the same time it will cause the vegetable matter to disappear more rapidly than would otherwise be the case. But the effect of such substances does not end here. They actually dispose or provoke—*predispose* chemists call it—the vegetable matter to produce acid substances, in order that they may combine with them, and thus cause the organic matters to disappear more rapidly than they otherwise would do—in other words, they hasten forward the exhaustion of the vegetable matter of the soil.

Such is the general action of *all* alcaline substances. This action they exhibit even in close vessels. Thus a solution of grape sugar, mixed with potash, and left in a warm place, slowly forms a sour substance called *melassic acid*—while, in cold lime-water, the same sugar is gradually converted into another acid called the *glucic*. But in the air other acids are formed in the same mixtures, and the changes proceed more rapidly. Such is the case also in the soil, where the elements of the air and of water are generally at hand to favour the decomposition.

But the *nature* of the alcaline matter which is present determines also the rapidity with which such changes are produced. The most powerful alcaline substances—potash and soda—produce all the above effects most quickly; lime and magnesia are next in order; and the alumina of the clay soils, though much inferior to all these, is far from being without an important influence.

Hence one of the benefits which result from the use of wood-ashes containing carbonate of potash, when employed in small quantities, and along with vegetable and animal manures, as they are in this country; but hence also the evil effects which are found to follow from the application of them in too large doses, or too frequently repeated. Thus in countries where wood abounds, and where it is usual, as in Sweden and Northern Russia, to burn the forests and to lay on their ashes as manure, the tillage can be continued for a

few years only. After two or three crops the land is exhausted, and must again be left to its natural produce.

SECTION VIII.—*Special effects of Caustic Lime upon the several varieties of organic matter in the soil.*

The effects of lime upon organic matter are precisely the same in kind as those of alcaline substances in general. They are only less in degree, or take place more slowly, than when soda or potash is employed. Hence the greater adaptation of lime to the purposes of practical agriculture.

1°. *Action of caustic lime alone upon vegetable matter.*—If the fresh leaves and twigs of plants, or blades and roots of grass, be introduced into a bottle, surrounded with slaked lime, and corked, they will slowly undergo a certain change of colour, but they may be preserved for years without exhibiting any striking change of texture. If dry straw be so mixed with slaked lime, it will exhibit still less alteration. In either case, also, the changes will be even less perceptible if, instead of slaked lime, the *carbonate* (or *mild* lime), in any of its forms, be mixed with these varieties of vegetable matter. On some other varieties of vegetable matter—such, for example, as are undergoing rapid decay, or have already reached an advanced stage of decomposition—an admixture of slaked lime produces certain perceptible changes immediately, and mild lime more slowly; but these changes being completed, the tendency of *lime alone* is to arrest rather than to promote further *rapid* alterations. Hence the following opinions of experienced practical observers must be admitted to be theoretically correct, in so far as they refer to *slaked lime acting alone.*

"If straw or long dung be mixed with slaked lime, it will be preserved." (Morton.)*

"Lime, mixed in a mass of earth containing the live roots and seeds of plants, will *not* destroy them." (Morton.)†

"Sir H. Davy's theory, that lime dissolves vegetable matter, is given up; in fact, it hardens vegetable matter." (Mr Pusey.)‡

These opinions, I have said, are probably correct in so far as regards the unaided action of slaked lime. They even express, with an approach to accuracy, what will take place in the interior of compost-heaps of a certain kind, or in some very dry soils; but that they cannot apply to the ordinary action of lime upon the soil, is proved by the other result, of universal observation, *that lime, so far from preserving the organic matter of the land to which it is applied, in reality wastes it*—causes, that is, or disposes it to disappear.

* *On Soils*, 3d edition, p. 181. † Ibid.

‡ *Royal Agricultural Journal*, iii., p. 212.

It is unfortunate, indeed, that opinions such as those above quoted should be so generally or broadly expressed by practical men, as they tend to propagate erroneous impressions.

2°. *Action of caustic lime on organic matter in the presence of air and water.*—In the presence of air and water, when assisted by a favouring temperature, vegetable matter, as we have already seen, undergoes spontaneous decomposition. In the same circumstances lime promotes and sensibly hastens this decomposition, altering the forms or stages through which the organic matter must pass, but bringing about more speedily its final conversion into carbonic acid and water. During its natural decay in a moist and open soil, organic matter gives off a portion of carbonic acid gas, which escapes into the air, and forms at the same time certain other acids, which remain in the dark mould of the soil itself. When quick or slaked lime is added to the land, its first effect is to combine with these acids—to form carbonate, humate, &c., of lime—till the whole of the acid matter existing at the time is taken up. That portion of the lime which remains uncombined, either slowly absorbs carbonic acid from the air, or unites with the carbonate already formed, to produce the known compound of hydrate with carbonate of lime* —waiting in this state in the soil till some fresh portions of acid matter are formed with which it may combine. But it does not inactively wait; it persuades and influences the organic matter to combine with the oxygen of the air and of the water with which it is surrounded, for the production of such acid substances—till, finally, the whole of the lime becomes combined either with carbonic acid, or with some other acid of organic origin.

Nor at this stage are the action and influence of lime observed to cease. On the contrary, this result will, in most soils, be arrived at in the course of one or two years, while the beneficial action of the lime itself may be perceptible for twenty or thirty years. Hence there is much apparent ground for the opinion of Lord Kames, "that lime is as efficacious in its (so-called) effete as in its caustic state." Even the more strongly expressed opinion of the same acute observer, "that lime produces little effect upon vegetables till it becomes effete," derives much support from experience, since lime is known to have comparatively little effect upon the productiveness of the land till one or two years after its application; and this period, as I have said, is in most localities sufficient to deprive even slaked lime of all its caustic properties.

Of the saline compounds† which caustic lime thus forms, either immediately or ultimately, some, like the carbonate and humate,

* That compound, namely, which is produced when quick-lime slakes spontaneously in the air, and which has been described in a previous paper.

† Saline compounds or salts are always formed when lime, magnesia, potash, soda, &c., combine with acids.

being very sparingly soluble in water, remain more or less permanently in the soil; others, like the acetate of lime,* being readily soluble, are either washed out by the rains, or are sucked up by the roots of the growing plants. In the former case they cause the removal of both organic matter and of lime from the land; in the latter they supply the plant with a portion of organic food, and at the same time with lime—without which, as we have frequently before remarked, plants cannot be maintained in their most healthy condition.

SECTION IX.—*Action of Mild or carbonate of Lime upon the vegetable matter of the soil.*

The main utility of lime, therefore, after it has first removed the sourness it found in the soil, depends upon its prolonged *after*-action upon the vegetable matter. What is this action, and in what consist the benefits to which it gives rise?

In answering this question, it is of importance to observe that all the effects produced by alcaline substances in general, whether by lime or by potash, in the caustic state, are produced in *kind* also by the same substances in the state of carbonate. The carbonic acid with which they are united is retained by a comparatively feeble affinity, and is displaced with greater or less ease by almost every other acid compound which is produced in the soil. With this displacement is connected an interesting series of beautiful reactions, which it is of consequence to understand.

The end or termination which nature, so to speak, has in view, in all the changes to which she subjects organic matter in the soil, is to convert it, with the exception of its nitrogen, into carbonic acid and water. For this purpose it combines, at one time, with the oxygen of the air, while at another it decomposes water, and unites with the oxygen or the hydrogen which are liberated, or with both, to form new chemical combinations. Each of these new combinations is either immediately preliminary to, or is attended by, the conversion of a portion of the elements of the organic matter into one or other of those simpler forms of matter on which plants live. Now, during these preliminary or preparatory steps, acid substances, as I have already explained, are among others constantly produced. With these acids the carbonate of lime, when present in the soil, is ever ready to combine: but, in so combining, it gives off the carbonic acid with which it is already united; and thus a continual, slow evolution of carbonic acid is kept up as long as any undecomposed carbonate remains in the soil.

* Acetate of lime consists of acetic acid, or vinegar, and lime.

I do not attempt to specify by name all the various acid substances which are thus formed during the oxidation of the organic matter, and which successively unite with the lime; because the entire series of interesting and highly important changes, which organic substances undergo in the soil, has as yet been too little investigated, to permit us to do more than speak in general terms of the nature of the chemical compounds which are most abundantly produced. Of two facts, however, in regard to them, we are certain—that they are simpler in their constitution than the original organic matter itself from which they are derived, and that they have a tendency to assume still simpler forms, if they continue to be exposed to the same united action of air, water, and alcaline substances.

Hence the compounds which lime has formed with the acid substances of the soil—the humate, ulmate, &c.,—themselves hasten forward to new decompositions, unite with more oxygen, liberate slowly portion after portion of their carbon, in the form of carbonic acid, and of their hydrogen in the form of water, till at length the lime itself is left again in the state of carbonate, or in union with carbonic acid only. This residual carbonate of lime begins again the same round of changes through which it had previously passed. It gives up its carbonic acid at the bidding of some more powerful organic acid produced in its neighbourhood; while this acid, by exposure to the due influences, undergoes new alterations, till it also is finally resolved into carbonic acid and water.

Two circumstances deserve to be borne in mind in reference to these successive decompositions—*first*, that, as they proceed, more easily-soluble compounds of lime are now and then formed, some of which are washed out by the rains and escape from the soil, while others minister to the growth of plants;—and, *second*, that very much carbonic acid is produced as their final result, of which also part is taken up by the roots of plants, and part escapes into the air. Thus at every successive stage a portion of organic matter is lost to the soil. If this quantity be greater than that which is yearly gained in the form of roots, or decayed leaves and stems of plants, or of manure artificially added, the soil will be gradually exhausted—if less, it will every year become more rich in vegetable matter.

It is also to be borne in mind, that although, for the purpose of illustration, I have supposed the carbonate of lime first formed in the soil to be subsequently combined with other acids, which gradually decompose and leave it again in the state of carbonate, yet it will rarely happen that the whole of the carbonate of lime in the soil will be brought, at one and the same time, into any of these new states of combination. In general, a part of it only is thus at any one time employed in working up the acid substances produced. But it is necessary that it should be universally diffused

hrough the soil, in order that it may be every where at hand to perform the important part of its functions above explained. It is only where little lime is present, or where decaying vegetable matter is in exceeding abundance, that the whole of the carbonate can at one and the same time disappear.

SECTION X.—*Summary of the chemical changes which Lime and organic matter mutually undergo in the soil.*

The changes, therefore, which lime and organic matter, supposed to be free from nitrogen, respectively undergo, and their mutual action in the soil, may be summed up as follows:—

1°. The organic matter, under the influence of air and moisture, spontaneously decomposes, and, besides carbonic acid which escapes, forms also other acid substances which linger in the soil.

2°. With these acids the quick-lime combines, and, either by its union with them, or with carbonic acid from the air, gradually loses its caustic state.

3°. The production of acid substances, by the oxidation of the organic matter, goes on more rapidly under the predisposing influence of the lime, whether caustic or carbonated. These acids combine with the lime, liberating from it, when in the state of carbonate, a slow but constant current of carbonic acid, upon which plants at least partly live.

4°. The acid organic matter which thus unites with the lime continues itself to be acted upon by the air and water, aided by heat and light—itself passes through a succession of stages of decomposition, at each of which it gives off water or carbonic acid, retaining still its hold of the lime, till at last, being wholly decomposed, it leaves the lime again in the state of carbonate—ready to begin anew the same round of change.

5°. During this series of progressive decompositions, certain more soluble compounds of lime are formed, by which plants are in part at least supplied with this earth, and the production of which enables the rains to carry off both lime and organic matter from the soil.

And, again, the more rapid the production of the acid substances which result from the union of the organic matter with oxygen, the more abundant in general also is the production of those gaseous and volatile compounds which it forms by uniting with hydrogen—so that, in promoting the formation of the one class of bodies, lime also favours the evolution of the other in greater abundance, and thus in a double measure contributes to the exhaustion of the soil.

The *disposing* action of lime to this twin form of decomposition, few varieties of organic matter can resist—and hence arises the well-known efficacy of lime, in resolving and rendering useful the

apparently inert vegetable substances that not unfrequently exist in the soil.

SECTION XI.—*Of the comparative utility of burned and unburned Lime.*

Is there no advantage, then, we may ask, in using caustic or burned rather than carbonated or unburned lime? If the ultimate effects of both upon the land be the same, why be at the expense of burning? Among other benefits arising from the use of burned lime may be enumerated the following :—

1°. By burning and slaking, the lime is reduced to the state of an impalpable powder, finer than could be obtained by any available method of crushing. It can in consequence be diffused more uniformly through the soil, and hence a smaller quantity will produce an equal effect. This minute state of division also promotes in a wonderful degree the chemical action of the lime. In all cases chemical action takes place between exceedingly minute particles of matter; and among solid substances the action is more rapid the finer the powder to which they can be reduced. Thus a mass of iron or lead slowly rusts or tarnishes in the air, but if the mass of either metal be reduced to the state of an impalpable powder —which can be done by certain chemical means—it will take fire when simply exposed to the air at the ordinary temperature, and will burn till it is entirely converted into oxide of iron, or oxide of lead. By mere mechanical division, the apparent action of the oxygen of the air upon metals is augmented and hastened in this extraordinary degree; and a similar heightening of the chemical influence of lime takes place when it is brought, in an impalpable state, into contact with the vegetable matter upon which it is intended to act.

2°. The effect of burned lime is more powerful and more immediate than that of unburned lime in the form of chalk, marl, or shell sand. Hence it sooner neutralises the acids which exist in the soil, and sooner causes that decomposition of vegetable matter of every kind to commence, upon which its efficacy, in a great degree, depends. Hence, when it can easily be procured, it is better for sour grass or arable lands, for such as contain an excess of vegetable matter, and especially for such as abound in that dead or inert form of organic matter which requires a stronger stimulus—the presence of more powerful chemical affinities, that is—to bring it into active decomposition. In such cases, the lime has already done much good before it has been brought into the mild state—by exposure in the soil—and, remaining afterwards in this state in the soil, it still serves, in a great measure, the same slower after-purposes, as the original addition of carbonate would have done.

3°. Besides, if any portion of it, after the lapse of two or three years, still linger in the caustic state, it will continue to provoke more rapid changes among the organic substances in the soil, than mild lime alone could have done.

4°. Further, quick-lime is soluble in water, and hence every shower that falls and sinks into the soil carries with it a portion of lime, so long as any of it remains in the caustic state. It thus reaches acid matters that lie beneath the surface, and alters and ameliorates even the subsoil itself.

5°. It is not a small additional recommendation of quick-lime, that limestone, by burning, loses about 44 per cent of its weight —chiefly carbonic acid—thus enabling nearly twice the quantity of lime to be conveyed from place to place at the same cost of transport. This not only causes a direct saving of money—as when the burned chalk of Antrim is carried by sea to the Ayrshire coasts—but an additional saving of labour also upon the farm—where the number of hands and horses is often barely sufficient for the necessary work.

SECTION XII.—*Action of Lime on organic substances which contain nitrogen—production of nitric acid and ammonia.*

I have hitherto, for the sake of simplicity, treated only of the action, whether immediate or remote, which is exercised by lime upon organic matter supposed to contain no nitrogen. Its action upon compounds in which nitrogen exists is no less beautiful and simple, perhaps even more intelligible and more obviously useful to vegetation.

There are several well-known facts which it is here of importance to consider—

1°. That the black vegetable matter of the soil always contains nitrogen. Even that which is most inert retains a sensible proportion of it. It exists in dry peat to the amount of about 2 per cent of its weight, and still clings to the other elements of the organic matter, even after it has undergone those prolonged changes by which it is finally converted into coal. Since nitrogen, therefore, is so important an element in all vegetable food, and so necessary in some form or other to the healthy growth and maturity of plants, it must be of consequence to awaken this element of decaying vegetable matter, when it is lying dormant, and to cause it to assume a form in which it can enter into and become useful to our cultivated plants.

2°. That if vegetable matter of any kind be heated with slaked lime, the whole of the nitrogen it may contain, in whatever state of combination it may previously exist, will be given off in the form of ammonia. The same takes place still more easily if a quantity

of caustic potash or caustic soda be mixed with the caustic lime. Though it has not as yet been proved by direct experiment, yet I consider it to be exceedingly probable that what takes place quickly in our laboratories, at a comparatively high temperature, may take place more slowly also in the soil, and at the ordinary temperature of the atmosphere.

3°. That when animal and vegetable substances are mixed with earth, lime, and other alcaline matters, in the so-called nitre beds,* ammonia and nitric acid are both produced—the quantity of nitrogen contained in the weight of these compounds extracted, being much greater than was originally present in the animal and vegetable matter employed (Dumas). Under the influence of alcaline substances, therefore, *even when not in a caustic state*, the decay of animal and vegetable matter in the presence of air and moisture causes some of the nitrogen of the atmosphere to become fixed in the soil in the form of ammonia or of nitric acid. What takes place on the confined area of a nitre bed happens without doubt in our lime composts, and may take place to some extent also in the wider area of a well-limed and well-manured field.

In the action of alcalies in the nitre bed, *disposing* to the production of nitric acid, we observe the same kind of agency, as we have already attributed to lime, in regard to the more abundant elements which exist in the vegetable matter of the soil. It gently persuades all the elements—nitrogen and carbon alike—to unite with the oxygen of the air and with that of water, and thus ultimately to form acid compounds with which it may itself combine.

The action of lime upon such organic matters containing nitrogen as usually exist in the soil, may, therefore, be briefly stated as follows:—

1°. These substances, like all other organic matter, undergo in moist air—and, therefore, in the soil—a spontaneous decomposition, the general result of which is the production of ammonia, and of an acid substance with which the ammonia may combine. This change is precisely analogous to that which takes place in such substances as starch and vegetable fibre, which contain no nitrogen. In each case, one portion of the elements of the organic substance unites with oxygen to produce an acid, the other portion with hydrogen to form one or more compounds possessed of alcaline or indifferent properties. Thus—

		With Oxygen.	With Hydrogen.
Vegetable matter	produces	Carbonic, ulmic, and other acids.	Marsh gas or other carbureted hydrogens.
Animal matter	produces	Carbonic, *nitric*, ulmic, and other acids.	Ammonia.

* The nitre beds of the continent of Europe are in reality large compost heaps, which are turned over and washed once or twice a year. The washings, when boiled down, yield saltpetre.

If the ammonia happen to be produced in larger relative quantity than the acids with which it is to combine, or if the carbonic be the only acid with which it has the opportunity of uniting, a portion of it may escape into the air. This rarely happens, however, in the soil—the absorbent properties of the earthy and other matters of which the soil consists being in most cases sufficient to retain the ammonia, till it can be made available to the purposes of vegetable life.

When caustic lime is added to a soil in which ammonia exists in this state of combination with acid matter, it seizes upon the acid and sets the ammonia free. This it does with comparative slowness, however—for it does not at once come in contact with the whole of the ammoniacal matter. It does so by degrees, therefore, so as to store up the ammonia in the pores of the soil till the roots of plants can reach it, or till the ammonia can itself undergo a further change by which its nitrogen may be rendered more fixed.

Carbonate of lime, on the other hand, still more slowly persuades the ammonia to leave the acid substances (ulmic, nitric, &c.), with which it is combined, and, yielding to it in return its own carbonic acid, enables it in the state of soluble carbonate of ammonia to become more immediately useful to vegetation.

2°. But in undergoing this spontaneous decay, even substances containing nitrogen reach at length a point at which decomposition appears to stop—an inert condition in which, though nitrogen be present in them as it is in peat, they cease sensibly to give it off in such a form or quantity as to be capable of ministering to vegetable growth. Here caustic lime steps in more quickly, and mild lime by slower degrees, to promote the further decay. It induces the carbonaceous matter to take oxygen from the air and from water, and to form acids, and the nitrogen to unite with the hydrogen of the water for the production of ammonia—thus helping forward the organic matter in its natural course of decay, and enabling it to fulfil its destined purposes in reference to vegetable life.

3°. But the ammonia which is thus disengaged in the soil by decaying organic matter, though not immediately worked up, so to speak, by living plants, is not permitted to escape in any large quantity into the air. The soil, as I have already stated, is usually absorbent enough to retain it in its pores for an indefinite period of time. And as in nature, and upon the earth's surface, the elements of matter are rarely permitted to remain in a state of repose, the ammonia, though retained apparently inactive in the soil, is yet slowly uniting with a portion of the surrounding oxygen,* and

* Nitric acid consists of nitrogen and oxygen. Water consists of hydrogen and oxygen. Ammonia consists of nitrogen and hydrogen. When ammonia combines with, or is oxidised by the oxygen of the atmosphere, its hydrogen forms water, while its nitrogen produces nitric acid.

forming nitric acid. When no other *base* is present, this nitric acid, as it is produced, unites with some of the ammonia itself which still remains, forming *nitrate of ammonia*—but if soda, or potash, or lime, be present within its reach, it unites with them in preference, and forms *nitrate of soda*, *nitrate of potash*, *or nitrate of lime.*

But lime, if present, is not an inactive spectator, so to speak, of this slow *oxidation* of ammonia. On the contrary, it promotes this final change, and, by being ready to unite with the nitric acid as it forms, increases and accelerates its production, at the expense of the ammonia which it had previously been instrumental in evolving.

4°. One other important action of lime, by which the same compounds of nitrogen are produced in the soil, may in this place be most properly noticed. It is a chemical law of apparently extensive application, that, when one elementary substance is undergoing a direct chemical union with a second *in the presence of a third* substance, a tendency is imparted to the third to unite also with one or with both of the other two, although in the same circumstances it would not unite with either, if present alone. Thus, when the carbonaceous matter of the soil is undergoing oxidation in the air—that is, combining with the oxygen of the atmosphere—it imparts a tendency to the nitrogen also of the air to unite with oxygen, which when mixed with that gas alone* it has no known disposition to do. The result of this is the production of a small, and always a variable, proportion of nitric acid during the decomposition in the soil of organic matter, which itself contains no nitrogen.

Again, it is an equally remarkable chemical law that elementary bodies which refuse to combine, however long we may keep them together in a state of mixture, will yet unite readily when presented to each other in what is called by chemists the *nascent* state—that is, at the moment when one or other of them is produced or is separated from a previous state of combination.

Thus when the organic matter of the soil decomposes water in the presence of atmospheric air, its carbon unites with the greater part of the oxygen and hydrogen which are set at liberty, and at the same time with more or less of the oxygen of the atmosphere—but at the same instant the nitrogen of the atmosphere, which is everywhere present, seizes a portion of the hydrogen of the water, and forms ammonia. Thus a variable, and in any one limited spot, a minute, but over the entire surface of the globe, a large quantity of ammonia is produced during the oxidation even of the purely carbonaceous portion of the organic matter of the soil.

Now in proportion as the presence of lime promotes this decay of vegetable and other organic matter in the soil—in the same propor-

* The atmosphere consisting, as the reader will recollect, of nitrogen and oxygen.

tion does it promote the production of ammonia and nitric acid, at the expense of the free nitrogen of the atmosphere, and this may be regarded as one of the valuable and constant purposes served by the presence of calcareous matter in the soil.

SECTION XIII.—*How the chemical changes produced by Lime upon organic matter directly benefit vegetation.*

The reader may not inquire how all these interesting chemical changes in the organic matter, which attend upon the presence of lime in the soil, are directly useful to vegetation, and yet it may be useful shortly to answer the question.

1°. Lime combines with the acid substances already existing in the soil, and thus promotes the decomposition of vegetable matter which those acid substances arrest. The further decompositions which ensue are attended at every step by the production either of gaseous compounds—such as carbonic acid and light carburetted hydrogen*—which are more or less abundantly absorbed by the roots and leaves of plants, and thus help to feed them—or of acid and other compounds, soluble in water, which, entering by the roots, bear into the circulation of the plant not only organic food, but that supply of lime also which healthy plants require.

2°. The changes it induces upon substances in which nitrogen is present are still more obviously useful to vegetation. It sets ammonia free from the compounds in which it exists already formed, and promotes its slow conversion into nitric acid, by which the nitrogen is rendered more fixed in the soil. It disposes the nitrogen of more or less inert organic matter to assume the forms of ammonia and nitric acid, in which states experience has long shown that this element is directly favourable to the growth of plants. And—

3°. It influences, in an unknown degree, the nitrogen of the atmosphere to become fixed in larger proportion in the soil, in the forms of nitric acid and ammonia, than would otherwise be the case; and this it does both by the greater amount of decay or oxidation which it brings about in a given time, and by the *kind* of compounds which, under its influence, the organic matter is persuaded to form. The amount of nitrogenous food placed within reach of plants by this agency of lime will vary with the climate, with the nature of the soil, with its condition as to drainage, and with the more or less liberal and skilful manner in which it is farmed.

SECTION XIV.—*Why Lime should be kept near the surface.*

The considerations presented in the preceding sections suggest important reasons why lime should be kept near the surface of the soil, since—

* Light carburetted hydrogen or marsh gas consists of carbon and hydrogen.

1°. The action of lime upon organic matter is almost nothing in the absence of air and moisture. If the lime sink, therefore, beyond the constant reach of fresh air, its efficacy is in a great degree lost.

2°. But the agency of the light and heat of the sun, though I have not hitherto specially insisted upon their action, are scarcely less necessary to the full experience of the benefits which lime is capable of conferring. The light of the sun accelerates nearly all the chemical decompositions that take place in the soil, while some it appears especially to promote. The warmth of the sun's rays may penetrate to some depth, but their light can only act upon the immediate surface of the soil. Hence the skilful agriculturist will endeavour, if possible, to keep some of his lime at least upon the very surface of his arable land. Perhaps this influence of light might even be adduced as an argument in favour of the frequent application of lime in small doses, as a means of keeping a portion of it always within reach of the sun's rays; and this more especially on grass lands, to which mechanical means can with difficulty be applied for the purpose of bringing again to the surface the lime that has sunk.

There are, at the same time, good reasons also why a portion of the lime should be diffused through the body of the soil, both for the purpose of combining with organic acids already existing there, and with the view of acting upon certain inorganic or mineral substances, which are either decidedly injurious, or, by the action of lime, may be rendered more wholesome to vegetation.

In order that this diffusion may be effected, and especially that lime may not be unnecessarily wasted where pains are taken by mechanical means to keep it near the surface, an efficient system of under-drainage should be carefully kept up. Where the rains that fall are allowed to flow off the surface of the land, they wash more lime away the more carefully it is kept among the upper soil; but where a free outlet is afforded to the waters beneath, they carry the lime with them as they sink towards the subsoil, and may have been robbed again of the greater part of it before they escape into the drains. Thus, on drained land the rains that fall aid lime in producing its beneficial effects, while in undrained land they in a greater or less degree counteract it.

SECTION XV.—*Action of Lime upon the inorganic or mineral matter of the soil.*

I have hitherto spoken only of the action of lime upon the purely organic part of the soil—that which contains only carbon, hydrogen, oxygen, and nitrogen. But its operation in regard to the inorganic substances contained in the soil is no less important.

1°. *The decaying vegetable matter* in the stems, roots, and leaves of plants, which form the so-called humus of the soil, contain a large proportion of the inorganic matter which was necessary to their

existence in the living state. As they decompose, this inorganic matter is liberated. By promoting this decomposition, therefore, lime sets free this mineral matter, and provides at once abundant organic and inorganic food to the growing plant. This result of the action of lime is no less important in reference to its fertilising quality than that by which it causes the production of those numerous changes in the purely organic matter of the soil to which I have already adverted.

If the vegetable matter decay rapidly, it will supply in abundance all the materials, both organic and inorganic, which new races of plants require to form their entire substance. If it be in an inert state, or decompose slowly, the food it contains remains locked up and comparatively useless to vegetation. In quickening the decay of this inert or slowly decomposing matter, it is easy to see, therefore, how lime should render the land more fertile, and should do so more sensibly where vegetable matter is more abundant.

2°. *The mineral and rocky fragments* in the soil are acted upon in a similar manner.

Among the earthy constituents of soils there often exist fragments of felspar and other minerals derived from the granitic and trap rocks, as well as portions of the slaty and other beds from which the soils have been formed, and which, as they crumble down, yield more and more of those inorganic substances on which plants live.

The decomposition of these minerals and rocks proceeds more or less rapidly under the conjoined action of the oxygen, the carbonic acid, and the moisture of the atmosphere. But the presence of lime promotes this decomposition, and the consequent liberation of the inorganic substances which the rocks contain.

The silicates of potash and soda are among the most important compounds which these mineral and rocky fragments contain. These silicates, after being heated to redness with quick-lime, readily yield a portion of their potash or soda to water poured upon the mixture. The same result follows, but more slowly, when, without being heated, the silicates and the lime are mixed together into a paste with water, and left for a length of time at the ordinary temperature of the atmosphere. It is reasonable, therefore, to suppose that, in the soil of our fields, a similar decomposition will slowly take place when quick-lime is mixed with it. It will take place, also, though still more slowly, when lime is added to it in the form of carbonate.

By some the liberation of potash and soda in this way is supposed to be the most important action exercised by lime in rendering the land more productive. With this extreme opinion I do not agree, though it must be conceded, I think, that in numerous instances a certain amount of benefit must follow from the chemical action it is thus fitted to exercise.

I have spoken of lime as liberating the inorganic constituents of the decaying vegetable matter of the soil. The stalks of the grasses and the straw of our corn-bearing plants also contain silicates of potash and soda, which lime sets free in hastening the decomposition of the vegetable matter of which they form a part. Besides liberating, it further decomposes these silicates, as it does those of the minerals in the soil, and sets their potash and soda free to perform those important functions they are known to exercise in reference to the growth of plants. I am inclined to consider this part of the action of lime as of nearly equal importance to vegetation, in many instances, with that which it exercises upon the mineral silicates.

While the potash or soda is set free in a soluble state, the lime unites with a portion of silica, forming a silicate of lime, of which traces are to be met with in nearly all soils. This silicate, again, is slowly decomposed by the agency of the carbonic acid of the atmosphere and of the soil, as I have already explained when speaking of this compound as one of the causes of the known fertility of soils formed from the decay of trap rocks.

3°. Potash and soda exist sometimes in considerable quantity, in our stiff clay soils, in combination with the silica and alumina, of which they chiefly consist. From their extreme tenacity, the air is in a great measure excluded from these soils, and hence chemical decomposition proceeds in them very slowly. The addition of lime alters their physical character, and, by making them more open, admits the air, and thus promotes its decomposing action upon them. But it acts chemically also, in the same way as it does upon the silicates already spoken of, and thus compels them to give up more freely to the roots of plants those mineral substances by which their growth is to be made more luxuriant.

SECTION XVI.—*Action of Lime on salts of iron, magnesia, alumina, and soda, when contained in the soil.*

1°. *Salts of iron.*—Lime, either in the mild or in the caustic state, possesses the property of decomposing the sulphate and other saline compounds of iron, which especially abound in moorish and peaty soils, and in many localities so saturate the subsoil, as to make it destructive to the roots of plants. Sprengel mentions a case in which the first year's clover always grew well, while in the second year it always died away. This, upon examination, was found to be owing to the ferruginous nature of the subsoil, which caused the death of the plants as soon as the roots began to enter into it.

When land is rendered unproductive by the presence of salts of iron, a dressing with lime will bring the land into a wholesome state without other aid than those of the drain and the subsoil

plough. If sulphate of iron be the cause of the evil, the lime will combine with the acid and form gypsum, (sulphate of lime,) while the *first* oxide of iron which is set free will, by exposure to the air, be converted into the *second* or red oxide, in which state this metal is no longer hurtful to vegetation.

The drain and the subsoil plough are useful auxiliaries to the lime in lessening the injurious effects of the compounds of iron, because they allow the rains to descend and gradually to wash away the noxious matter which has accumulated in the under soil —because they permit the descending water to carry with it portions of the lime in a state of solution, and thus to spread its good effects through the whole soil—and because they admit successive supplies of air as deep as the bottom of the drains, by which, while the action of the lime is promoted, those other good effects also are produced which the oxygen of the atmosphere can alone accomplish. In fact, unless an outlet for the surface water be thus provided beneath, by which the lime may be enabled to descend, and the rains to wash away slowly the noxious substances from the subsoil, even the addition of a copious dose of lime will only produce a temporary improvement.

2°. *Salts of magnesia and alumina.*—Lime decomposes also the sulphates of magnesia and of alumina, both of which, but especially the former, are occasionally found in the soil in too large proportions, and, being very soluble salts, are liable to be taken up by the roots in such quantity as to be hurtful to growing plants. With the sulphuric acid of these salts the lime forms gypsum, as it does with the acid of sulphate of iron when this salt is present in a soil to which it is added: besides removing the evil effects of these very soluble sulphates, therefore, it exercises the beneficial action which gypsum is known to exhibit upon many of our cultivated crops.

Alumina has the property of combining readily with many vegetable acids, and in the clay soils exercises a constant influence —though more feeble in degree than that of lime—in persuading organic matter to those forms of decay in which acid compounds are more abundantly produced. Hence, clay soils almost always contain a portion of alumina in combination with organic matter. These organic compounds are decomposed by lime, and, by the more energetic action of this substance, their constituents are sooner made available to the wants of new races of plants.

3°. *Common salt and sulphate of soda.*—I shall bring under your notice only one other, but a highly important, decomposing action, which lime exercises in soils that abound in vegetable matter. In the presence of decaying organic substances the carbonate of lime is capable of slowly decomposing common salt, producing carbonate of soda and chloride of calcium. It exercises also a similar decomposing effect even upon the sulphate of soda, and according to

Berthollet,* incrustations of carbonate of soda † are observed on the surface of the soil, *wherever carbonate of lime and common salt are in contact with each other.* If we consider that along all our coasts common salt may be said to abound in the soil, being yearly sprinkled over it by the salt sea winds, we may safely conclude, I think, that the decomposition now explained must take place extensively in all those parts of our island which are so situated, if lime in any of its forms either exists naturally or has been artificially added to the land. The same must be the case also in those districts where salt springs occur, and generally over the new red-sandstone formation, in which sea-salt more especially occurs.

And if we further consider the important purposes which the carbonate of soda thus produced may serve in reference to vegetation—that it may dissolve vegetable matter and carry it into the roots—that it may form soluble silicates, and thus supply the necessary silicious matter to the stems of the grasses and other plants—and that rising, as it naturally does, to the surface of the soil, it there, in the presence of vegetable matter, provokes to the formation of nitrates, so wholesome to vegetable life—we may regard the decomposing action of lime by which the carbonate of soda is produced from common salt, as in many localities fully equal in importance to that by which it liberates alcaline matter from the mineral silicates, or from those which exist in the parts of plants.

SECTION XVII.—*Of the exhausting effects of Lime.*

The theory of the action of lime, as above explained, shows clearly how it comes to be exhausting.

Several important facts, in regard to what may be called the historical action of lime, are familiar to practical men. Thus—

1°. When lime is applied to the land for the first time, it produces a remarkably fertilising effect.

2°. This effect continues for many years, the land yielding frequent crops of corn, or long years of rich pasture, without any addition of manure.

3°. New doses of lime renew its fertility again as it begins to flag, but each successive dose must be larger than the former to produce an equal effect.

4°. But at last the crops begin to fail beyond the power of lime to restore them: new additions of lime produce no sensible effect; and thus the use of lime is sometimes given up as a waste of money in one district, while the practice is vigorously prosecuted in another.

* Dumas, *Traité de Chimie*, ii., p. 334.

† Of *Trona* or *Natron*, which is what is called a *sesqui*-carbonate of soda—containing one-half more carbonic acid than the common soda of the shops.

"An overdose of marl," says Lord Kames, "produces for a time large crops, but at last renders the soil incapable of bearing either corn or grass, of which there are many examples."

In the district of the Isère in France, a tract of country, which produced in its natural state no grain but rye, and yielded only three returns of the seed, grew wheat readily when marled, and gave eight returns for the seed. Eight returns of wheat instead of three returns of rye! But, after forty years marling, it yields now only four returns of wheat. It continues to grow the more valuable grain, but the crops are only one-half their original bulk.

The same is true of lime in all its forms. And when land is brought into this condition, even rich manure scarcely succeeds, after years of carefully-restorative treatment, in bringing the soil back again to its former productive condition.

Hence the proverb, which has obtained a place in almost every European language—*Lime enriches the fathers and impoverishes the sons.*

Two questions naturally arise in reference to this result:—

How does lime cause the land to become exhausted?

Is this a necessary consequence of the use of lime, and ought it therefore to be forbidden or discontinued?

SECTION XVIII.—*How Lime exhausts the land.*

Lime acts in several ways so as ultimately to lead to this result. Thus—

1°. As the organic matter decays more rapidly, the mineral substances which exist in it are also liberated in larger proportion than if the land had not been limed, and are thus brought into a condition in which they can be more abundantly removed from the soil by the agency of natural causes.

2°. The same is true of the soluble substances contained in the mineral and rocky fragments which are mixed with the soil. Whatever amount of action lime may exercise in liberating potash, soda, magnesia, silica, sulphuric acid, or phosphoric acid from these fragments, it will to that extent make these substances more easily and quickly removable from the soil.

But as the absolute quantity of potash, soda, &c., in all our soils is really enormous, though the proportion compared with their other constituents is small, it does not at first appear how the mere removal of a certain part of these substances should have a very serious effect upon the general fertility of any piece of land. Still it is not difficult to comprehend one way, in which the liberation of potash and other valuable matters from this source may by the action of lime be for a time rendered large, and may afterwards, for another period, be very greatly diminished.

All the mineral fragments are of an appreciable size. The lime

acts upon the exterior of these fragments, and liberates, we shall suppose, the alcaline matter. But the surface of the fragment does not on that account necessarily crumble down and expose a fresh face to the action of the lime. On the contrary, the old surface may adhere, surrounding the fragment with a coating through which the lime cannot act, and may thus prevent the further liberation of alcaline or other soluble substances, though these may still be abundant in the interior of the mineral mass.

By an action of this kind the surface of all stones—except limestones—which lie immediately beneath a layer of peat, come to have the same uniform gray silicious covering, so that the real nature of the stones can only be discovered by breaking them. The acid matter of the peat dissolves their iron from red sand-stones, the alumina from hard clay-stones; the lime, magnesia, and alcaline matter from fragments of whin-stone, and even upon flint it acts in a similar manner, leaving the same insoluble silicious coating upon all. It is so with the fragments of rock upon which lime acts in the soil; and it is easy, therefore, to understand how any liberation of alcaline or other matter from such fragments may at one time be large, and yet may afterwards diminish in a very sensible degree.

3°. Now these various substances, organic and inorganic, being decomposed, and their constituents set free more abundantly and more rapidly, the roots of plants obtain them more readily and in greater abundance; and thus the plants themselves grow more rapidly and to a larger size, and perfect all their parts more completely. In other words, larger crops are grown, and by those larger crops much more matter of every kind is carried off the soil.

But besides the nitrogen, carbon, and other so-called organic elements which the plant draws from the soil, it takes up at least eight or nine mineral substances in greater or less proportion. These are sulphur, phosphorus, chlorine, potash, soda, lime, magnesia, and the oxides of iron and manganese. The larger the crop the greater the quantity of each of these which is carried off; and therefore, in so far as lime is the means of causing larger crops to grow, in like proportion must it be the means of causing the land to be more rapidly exhausted of all these substances. The more rapid exhaustion of limed land, therefore, is caused mainly by the production and removal of a larger amount of produce in a given time.

Other considerations, however, have also a direct bearing upon this subject. In our climate, the rains which fall upon the soil cannot fail to wash soluble matter out of it. When the land is thoroughly drained and subsoiled, so that the rain sinks where it falls, and makes its way through nearly three feet of soil before it escapes, it is a question whether, in ordinary circumstances, it will carry away much more than it brings with it from the air. The vegetable matter of the soil tends to retain the soluble saline matter,

and to keep it from being washed away; and this is another of the useful purposes on account of which its presence, in considerable proportion, becomes desirable where we wish to maintain a soil in a state of high fertility.

But the lime, as we have seen, diminishes the proportion of vegetable matter in the soil, and at the same time increases the amount of soluble matter set free: that is to say, it brings more valuable matter into a soluble condition, while it renders the soil less capable of retaining it. The rains, therefore, ought to have more power over highly and frequently limed land in washing out the valuable kinds of food for plants which it contains. They may in fact be one of the natural instruments by which the exhausting of limed land is immediately produced.

SECTION XIX.—*Does Lime necessarily exhaust the land?*

To this question the considerations above presented enable us to answer in the negative. We have already laid down, as a principle in practical agriculture, that, in our climate, the addition of successive doses of lime at certain intervals is necessary to the highest fertility of the land. It is the part of enlightened practice so to treat the land besides, that this addition of lime shall not prove an instrument of final exhaustion. The exhaustion produced by the use of lime has always been observed in places where either successive doses of lime had been laid on as the sole application to the land, or where too scanty supplies of other manure had been given to the fields.

Now, where lime only is given to the land, it is most unreasonable to expect its fertility to be maintained. Besides the purely organic matter carried off, the nine mineral substances mentioned in the preceding section are yearly removed from the soil by the crops, and only one of these, the lime, is returned in the form of an artificial application. Can anything else but exhaustion follow from such practice?

Again, the crops are greatly larger than before, and, therefore, the quantity of all these substances carried off must be much greater than usual. A more speedy exhaustion, therefore, must be expected than if only the ordinary poor crops had been reaped.

Nor do small manurings of other kinds suffice to prevent this exhaustion. If an ordinary manuring be applied while an extraordinary crop, or a series of extraordinary crops, is carried off the land, exhaustion must follow as certainly, though more slowly, as if nothing but lime had been laid on.

To keep land in good condition, we must, as a general rule, add as much of every thing as we carry off. Let this be done upon limed land, and no exhaustion need be feared. If the land yield us large crops, we ought as liberally to manure it. We cannot

take out of the land constantly, and add nothing, without impoverishing it; but we can add enough to supply all we carry off, and yet farm our land profitably.

This is now understood by our best practical men, and in Germany is expressed by the rhyme—

> The use of marl without manure
> Will only make the farmer poor.

SECTION XX.—*Ought the use of Lime ever to be forbidden, or ought it to be continued, resumed, and regulated?*

The function of lime in the soil, and the cause of the exhaustion produced by it, being both clearly understood, the proper course to be adopted, both by landlord and by tenant, in regard to the use of it, becomes plain and intelligible also.

1°. *Ought the use of lime ever to be forbidden?*—It would be improper to decide this so absolutely in the negative, as to say that a proprietor should have no discretion in any case to forbid a bad tenant from continuing to add lime to the utter exhaustion of his land. It is better, however, to give such a tenant notice to quit, than by enforcing a regulation which is inconsistent with high farming to put it out of the power of a good husbandman to bring his land into the highest state of cultivation.

Seeing how often, during a former generation, uninstructed tenants ruined their land by constant liming—and being themselves ignorant of the way in which lime operated, and unable therefore to see any remedy, except in prohibiting the use of lime altogether—both proprietors and agents have introduced clauses into their agreements by which the farmers over entire estates have been forbidden for the future to add a particle of lime to their land. The ancient illustration of forbidding the use of fire, because of the dangerous burnings it sometimes caused, applies to this as well as to many other cases. It is profitable to apply lime: it is not necessarily exhausting—why then should it be forbidden?

2°. *Ought the use of lime to be resumed?*—In some districts, in consequence of the total absence of any good effect from further applications, the use of lime has been voluntarily abandoned by practical men. Ought it in such districts to be again brought into use?

As a general rule, it ought. And the reasons are plain to the reader of the preceding pages. Theory says that a certain small proportion of lime is necessary to every plant, as part of its natural [illegible]d, and this it ought to be able to collect easily and rapidly. [illegible] e says, that land otherwise well treated ceases to produce [illegible], unless a certain quantity of lime be added to it along [illegible]ures usually applied. No district, therefore, to which

lime or marl has in former years been found to be of service, can long be maintained in a high state of fertility, unless calcareous matter in some form be mixed with it from time to time. But, in special cases, it may not be proper at once to resume the application of lime. So much may have been incorporated with the soil in past years, that it may be unnecessary, and therefore inexpedient, to recommence the practice of liming or marling for years to come. The past history of the farm, however, or a chemical analysis of the soil, can alone determine where such special cases exist.

3°. *Ought the application of lime to be regulated?*—Were our tenantry once adequately instructed, neither restrictions as to crops nor regulations as to lime would be required. This proper state of education among the agricultural classes of the country, constitutes that utopian condition to which we look forward as the highway to that great and rapid improvement which British agriculture is hereafter destined to attain. But while education is spreading, restrictions and regulations cannot in most cases be avoided.

In regard to lime, therefore, the erroneous idea must be dispelled from the minds of all parties, that lime and manure, in the ordinary sense of the term, are identical. Clauses will then disappear from agreements—such as that tenants shall lime *or* manure once within so many years—that for every ton of hay or straw sold off the farm, so much manure *or* lime shall be brought back, and so on. Clauses such as these are not only evidences of defective knowledge, but they encourage and hasten on the very evils which protracted and injudicious liming is sure in the end to produce.

In like manner, tenants who lime once and manure once in a seven years' rotation,* will no longer speak of having manured twice in seven years, and thus having done well by their land—but the functions of each application being rightly understood, the manuring will be prosecuted more, while the liming may not be attended to less.

The addition of lime to land in ordinary condition should be regulated so that for every ton of lime so many—perhaps ten at least—of farm-yard manure should be added. Or, in the absence of farm-yard manure an equivalent of some other analogous manure—guano, rape-cake, bones, &c., should be substituted. The condition of the land of course, its richness or poverty—its condition as to previous liming, &c., must be taken into consideration in determining the relative proportions in which the lime and manure are to be added. And in districts where yearly holdings exist, all compensation for unexhausted lime should be contingent upon the application also of the due proportion of enriching manure.

* Such as that followed on a farm I lately visited in Denbigh, where turnips, with a heavy manuring, are followed by wheat, barley, seeds for two years, then wheat, after seven to ten tons of lime on the clover stubble, followed by barley, and then again turnips, with farm-yard manure.

DECISIONS IN THE SUPREME COURTS CONNECTED WITH RURAL ECONOMY.

FROM 21ST JANUARY TO 20TH JULY 1848.

(Court of Session.)

"Sea-Beach," in Bounding Title, synonymous with "Sea-Shore"—Use of Lands by Fishermen under 29 *Geo. II.* c. 23.—A feu-contract was entered into with certain parties, in the year 1785, by the Duke of Gordon, at that time proprietor of the burgh of barony of Gordonsburgh, (Fort-William,) in the county of Inverness, whereby they became entitled to feu-charters to the subjects therein mentioned, on certain specified terms. In the contract, one of these subjects was described as bounded "on the north by the *sea-beach.*" In 1833, Henry and William Ainslie came to be proprietors of this subject, having acquired the one half under a disposition bearing to proceed upon the contract of 1785, and holding the other half under a feu-charter from Sir Duncan Cameron of Fassfern, now heritable proprietor of Gordonsburgh,—which charter contained the same description of the subject as the contract of 1785, but expressly reserved to the superior and his heirs, and to "the inhabitants of the burgh deriving right from them, not only free access by all the streets, roads, and lanes thereof, as presently enjoyed and used, but also the full, free, and unlimited use and exercise of the sea-beach and sea-shore, and free access thereto, all which is expressly reserved from and noways included in these presents." In June 1843, Sir Duncan Cameron, and Donald Gunn, a fisherman and feuar of the burgh of barony, raised an action against the Messrs Ainslie, alleging that they were erecting buildings and otherwise encroaching upon the ground or sea-beach to the north of the real boundary of their feu, and between that boundary and the sea-shore, and that they were thereby interfering with the use of a certain road and of the sea-beach, to which, for drying nets, &c., the fishermen and inhabitants of Gordonsburgh had a prescriptive right; and praying to have the right of property in the *sea-beach* secured to Sir Duncan, and the use of the road and sea-beach to the feuars of Gordonsburgh. Sir Duncan proposing to ascertain the facts which he alleged by a jury trial, the defenders objected to his obtaining an issue as to the right of property which he claimed, in respect that they themselves being entitled, by the contract of 1785, to all the ground up to the *sea-beach*, and "sea-beach" being a term synonymous with "sea-shore," the right to anything beyond the "sea-beach," which was their boundary, must be, not in Sir Duncan, but in the crown. They also objected to an issue as to the prescriptive use of this ground by the fishermen in drying their nets, &c., because the right so to use the sea-

shore up to high water-mark, and for 100 yards beyond it, where the land was waste or uncultivated, was conferred upon them by statute, (29 Geo. II. c. 23,) and consequently the defenders, on the one hand, had been unable to challenge that use as an encroachment upon their rights under the contract; and, on the other hand, the fishermen were not entitled to found upon a use arising from statutory privilege to the effect of creating a servitude, or in support of a prescriptive title. Upon the former point, Sir Duncan contended that "sea-beach" and "sea-shore" were not convertible terms, and that there was or might be a space of "beach" between the "shore" and the defenders' feu, to which, being "beach," they had no title, and which, not being "shore," was not the property of the crown; and upon the latter point it was argued that it was not to be assumed before proof, that the alleged possession was wholly derived from the statute. The Lord Ordinary (Wood) reported the case, and the Court (First Division) decided in favour of the defenders upon both points.* — *Cameron and Gunn* v. *Ainslies, 21st January* 1848; *Jurist*, vol. xx. p. 130.

Landlord and Tenant—Lease—Renunciation—Fodder of last crop.—Mr Hall Pringle was tenant of the farm of Hatton, in the county of Fife, for a term of 19 years after Martinmas 1839, under a lease which stipulated *inter alia* that in no one of the last 3 years of the lease, should there be more than 40 acres of ground sown with wheat, and that at the end of the lease there should be at least 35 acres of grass which had been for 2 years pastured. The lease bound the tenant "not to remove or dispose of any fodder, straw, or turnips," "produced on the lands," ("hay and straw of the last crop excepted,) and to lay the whole dung thereby produced upon the said lands;" also "to leave to the proprietor or incoming tenant, at a valuation, all the dung made on the farm after the sowing of the last crop," and further, to "allow the landlord or incoming tenant to sow grass seeds, along with the last crop, on all or any part of the lands which shall have been in summer fallow or green crops the preceding year." After several sequestrations for rent by the landlord, Captain James Erskine Wemyss of Wemyss, Pringle obtained decree of cessio in March 1844; and on the 26th of April following, he renounced his lease by a deed, which, after narrating the above lease, proceeded thus: "And seeing that, in consequence of the embarrassed state of my affairs, I am unable to continue as tenant in the said lands and manage the same; therefore I have renounced and overgiven, &c., to and in favour of the said James Erskine Wemyss, &c., the said tack, and my possession of the several lands and others foresaid, in

* An issue was allowed upon the remaining question as to the road; but this was unobjected to, and it only involved a disputed matter of fact.

virtue thereof, and all claim, interest, or advantage I could have, or pretend therein, with the whole clauses and obligements therein contained in my favour, and all that has followed, or may be competent to follow thereupon for ever. And I bind and oblige myself, &c., to flit and remove, &c., forth and from the same against the term of Martinmas next 1844 years." In June 1844, the landlord's agent wrote to the agents of Pringle's creditors, to know if it was their "intention to prevent Captain Wemyss from letting or otherwise disposing of the farm, just as if the lease which Mr Pringle held had come to its natural termination, and he had been removed." No obstruction was offered by the creditors, and the farm was relet, and grass seeds were sown in terms of the clause to that effect in the lease. In May 1844, John Drysdale, Esq., of Kilrie, Henry Beveridge, banker in Kirkaldy, and Messrs Tosh and Gibson, writers in Kirkaldy, having advanced sums to relieve the tenant under the sequestrations, constituted their claims against him by decree, and poinded the growing crop on the farm, including the straw and fodder, and thereafter obtained a warrant to sell them. Captain Wemyss had previously obtained a sequestration in security of the rent of crop 1844, and the poinding creditors offered him payment of all advances made for that crop, together with security for or consignation of the rent. But he denied their right to the fodder altogether, and obtained an interdict from the Sheriff against its sale. The poinding creditors brought this case to the Court of Session by advocation, and the Lord Ordinary (Wood) reversed the decision of the Sheriff, chiefly upon the ground that, from the state of the facts, and the terms of the renunciation, coupled with the terms of the lease, the crop of 1844, which was the last crop *de facto*, was to be held as the last or way-going crop *in law* under the lease, and that therefore the fodder of that crop was the absolute property of the tenant, or of his creditors, who stood in his right. Captain Wemyss reclaimed, and argued that the exception in the tenant's favour, in the lease of the hay and straw of the last crop, had also its counterpart in the provisions as to the cultivation in the last 3 years of the lease, which counterpart had not been fulfilled; and that, by the terms of the renunciation, the tenant neither reserved nor transferred from one year to another his benefits under the lease, but wholly surrendered them. The creditors, on the other hand, maintained that the effect of the transaction was to put the tenant in exactly the same position as if the lease had come to a natural termination; and that this view was strengthened by the fact, that the lease merely regulated the *use* of the fodder, and neither as to the last, nor as to any other year of the lease, did it take the *property* of the fodder out of the tenant, or give it to the landlord. The Court (First Division) was equally divided upon the point—the Lord Justice-General, and Lord Fullerton, being in favour of the landlord's view, and Lords

Mackenzie and Jeffrey in favour of the creditors. The whole other judges being consulted, a majority (7 to 6) decided against the Sheriff's judgment, and in favour of the creditors.—*Drysdale and others* v. *Wemyss*, 27*th January* 1848; *Jurist*, vol. xx. p. 140.

Use of Water—Aqueduct—Prescription.—Lord Blantyre is proprietor of the lands of Duntocher, and Mr William Dunn of the adjoining lands of Faifley, both in the county of Renfrew. In their upper and lower portions, the boundaries between these estates is a stream called the Duntocher Burn; but in the middle portion Lord Blantyre is proprietor of both banks of the stream, his predecessors having acquired from Mr Dunn's authors a narrow stripe of the bank on the Faifley side, called "The Holm." Through the lands of Faifley there runs a stream, called the Cochney, which, in its original course, joined the Duntocher *below* "The Holm;" but, from time immemorial, a large portion of the Cochney had been diverted into an artificial cut or aqueduct, for the purpose of turning mills upon Faifley—a part of the Duntocher being also diverted into this aqueduct, in the year 1773, by a special agreement between the then proprietors; and the whole waters of the aqueduct were discharged into the Duntocher by a tail-race *above* "The Holm," and above certain mills belonging to Lord Blantyre, which they ever after contributed to serve. The aqueduct was wholly upon Mr Dunn's land, and had always been under the exclusive management of the proprietors of Faifley. This being the state of matters down to about the year 1832, Mr Dunn commenced operations to withdraw the water, or at least a part of it, from the aqueduct, and to discharge it into the Duntocher, below "The Holm," but still at or above the natural point of confluence. Lord Blantyre thereupon brought an action in the Court of Session against Mr Dunn,—the main contest in which ultimately came to be, whether, upon the facts as above stated, Mr Dunn was bound to discharge the whole water in the aqueduct into the Duntocher by the old tail-race, or whether he was entitled, so far as the said water was derived from the Cochney, to discharge it at any point not below the natural confluence of the two streams. The Lord Ordinary (Ivory) reported the cause upon cases to the Court, (Second Division,) and their Lordships pronounced an interlocutor, the substantial import of which was, that Mr Dunn had no right to do anything tending to withdraw, from the discharge by the original tail-race, any part of the water which, before such operation, had flowed into the Duntocher at that point, and ordaining him to shut up such cuts, &c. as he had already made.—*Lord Blantyre and Guardians* v. *Dunn*, 28*th January* 1848; *Jurist*, vol. xx. p. 154.

Turnpike Road Acts—Justices of the Peace—Review by Court of Session.—On the 28th August 1847, Alexander Strathern,

writer in Glasgow, presented a petition and complaint to the Justices of the Peace for the county of Stirling, against one Parlane Campbell, under the General Turnpike Act and the Stirlingshire Road Act, (1 and 2 Wil. IV., c. 43, and 3 and 4 Vict., c. 101,) for contravention of their provisions, in playing at the dangerous game of "long bools"* upon the turnpike road, to the annoyance of passengers. In the petition, Mr Strathern was designed as "authorised and empowered"† to prosecute "by James M'Laren, Esq." &c. "a qualified trustee;" and a mandate to this effect accompanied the petition. Warrant of citation, thereupon granted, was signed by the same Mr M'Laren and a Mr George M'Intosh, both Justices of the Peace and Road Trustees for the county. At the trial before the Justices, various objections were taken by Campbell to the competency of the prosecution at the instance of Mr Strathern; but they were repelled, and Campbell was fined in the sum of £1, 1s. The fine not being paid, the Justices, after the usual search had been reported, granted warrant of imprisonment for 20 days. Campbell being incarcerated under this warrant, presented a bill of suspension and liberation to the Court of Justiciary, which that Court, upon the 22d November 1847, refused to entertain, on the ground that the proceedings were of a civil nature, and did not fall within their review. Campbell then presented a note of suspension and interdict to the Court of Session, pleading that Mr Strathern had no legal authority to prosecute under the General Turnpike Act, (§ 109,) which only vested the power of delegation in the whole body of trustees; and that the warrant of citation was illegal, both because one of the Justices who signed it was the party who granted the authority to sue, and because both the Justices who signed it were Road Trustees. The Court (First Division,) adhering to the judgment of the Lord Ordinary on the Bills, (Jeffrey,) refused the note, on the ground that it was incompetent under the 114th‡ clause of the General Turnpike Act.

* The 96th clause of the General Turnpike Act enacts, "That if any person shall play at football, tennis, fives, cricket, or any other game or games, upon any turnpike road, or on the sides thereof, or in any exposed situation near thereto, to the annoyance of any passenger or passengers," he shall forfeit, &c.

† The 109th clause of the General Turnpike Act declares, "That it shall be lawful for the Procurator-fiscal, and for the trustees of any turnpike road, or any person authorised by them, or any one of their number, to prosecute," &c., "before the Sheriff or Justices of the Peace of the shire," &c.

‡ This clause enacts "That any person who shall think himself or herself aggrieved by any judgment or proceedings of any Justice or Justices of the Peace, in the execution of this act, for which no particular relief has been hereby provided, may, within three months after such judgment or proceedings, but not afterwards, appeal to the Justices of the Peace at the Quarter Sessions," &c.; "and where, by this act, the adjudging of any penalty, forfeiture, fine, or the determining the amount of any payment, damages, or expenses, or any other matter, is committed to any Justice or Justices of the Peace, or to the Sheriff, or the Justices of the Peace assembled in their Quarter Sessions, originally or by appeal, all judgments, determinations, and proceedings of

Their Lordships, however, intimated an opinion, that the reasons of suspension themselves were, in reality, not maintainable.—*Campbell* v. *Strathern, 9th February* 1848; *Jurist*, vol. xx. p. 214.

Salmon-fishing—Prescriptive Possession—Tweed Fishery Act.—Cairn Net Fishing.—The lands of Littledean, belonging to the Misses Williamson Ramsay, the glebe of the minister of Maxton, and the lands of Maxton, or Govansland, belonging to the Duke of Roxburgh, all in the county of Roxburgh, lie contiguous to each other, and along the south bank of the river Tweed, in the order in which they are here mentioned, Littledean being the western or uppermost of the three. The right of salmon-fishing on the whole of these lands was claimed, in the year 1813, by the late Lord Polwarth, who was proprietor of the opposite or north bank of the river, and also of the south bank next below them. Litigation between him and the Misses Ramsay's author resulted in a decree declaring the right to these fishings to belong to the latter. The Duke of Roxburgh, however, was not a party to this litigation; and the Misses Ramsay now brought an action against the Duke, in consequence of his attempting to disturb their possession of the fishings within the above limits. The titles of both parties contained a clause *cum piscationibus;* but, on the part of the Misses Ramsay, the right claimed was supported by an allegation that they had possessed or exercised it for more than 40 years, while on the part of the Duke there was no averment of possession. At a jury trial for determining the facts, the possession proved on behalf of the Misses Ramsay, was fishing by means of nets attached to cairns, which were built upon the bank and projected into the stream. They obtained a verdict, subject to the opinion of the Court, upon the legal effect of this mode of fishing. Upon this point it was argued for the Duke, that the only mode of proving possession of salmon-fishing recognised in the law of Scotland is by *net and coble*, and that cairn-net fishing is, in fact, illegal. The Court, however, (Second Division,) holding that the Tweed Fishery Act, 11 Geo. IV. c. 4, (1830,) * recognised, at least by implication, the

such Justice or Justices, not appealed from as aforesaid, and of such Sheriff or Quarter Sessions, shall be final and conclusive, and shall not be subject to review by advocation or suspension, or by reduction, or by any process of law or court whatsoever; any law or usage to the contrary notwithstanding." On the point of competency, see the case of Craigie *v.* Mill, 11th Feb. 1826, 4 Sh. 477; and 2 W. and S. App. cases, 642; and the case of Alexander *v.* Seymour, 2d Dec. 1828, 7 Sh. 117.

* The Tweed Fishery Act, § 26, enacts that it shall not be lawful "to affix any net, commonly called a cairn net, to any islet or cairn not connected with, or adjoining to the banks of any of the said rivers or streams, nor to build any cairn in any part of such river or stream, which cairn shall not adjoin the bank thereof:" and § 10, after enumerating divers illegal obstructions to the run of the fish, provides "that nothing herein contained shall be deemed or construed to alter or affect the modes or methods for taking and killing fish in the said rivers and waters, other than such as are by this act specially prohibited."

legality of cairn-net fishing in the river Tweed and its tributaries, sustained the verdict for the Misses Ramsay.—*Williamson Ramsay v. Duke of Roxburgh*, *9th February* 1848; *Jurist*, vol. xx. p. 217.*

Statute 8 *and* 9 *Vict. c.* 83—*Poor-law Assessment—Means and Substance—Interest of Heritable Debt a deduction from assessable income.*—Alexander M'Neel, Esq., residing in Stranraer, and deriving an income as agent to a bank and collector of customs there, was assessed for poor's rates in that parish for the year 1847-8 upon means and substance, in accordance with the mode of assessment there adopted under the Poor-law Act 8 and 9 Vict. c. 83.† The notice of assessment rated Mr M'Neel's means and substance at £460, under a deduction of 20 per cent "on account of precarious income;" upon receiving which Mr M'Neel wrote to the Parochial Board, submitting that salary for personal services was not income from means and substance in the sense of the statute, but if it were so held, claiming deduction for "incumbrances," to the amount of £328, said to arise from "borrowed money, annuities to relatives and others." The Parochial Board dismissed this appeal, and refused a reference of the matter to the Board of Supervision. Mr Henry Watt, the collector of the parish, having obtained a summary warrant of distress to recover the amount of assessment, Mr M'Neel presented a note of suspension and interdict, in order to stay proceedings and to try the question. The only point urged in the litigation was, the right to claim deduction for the alleged incumbrances. On being applied to by the Parochial Board extrajudicially for the particulars of these incumbrances, Mr M'Neel only offered to furnish them if they agreed to a reference of the cause, and this they declined to accede to; but in the judicial proceedings Mr M'Neel expressed his readiness to enter into full details. The Lord Ordinary (Jeffrey in the Bill-chamber) refused the note, principally on the ground that the *onus probandi* all along lay on Mr M'Neel, that he had not supplied full information to the Parochial Board, and that he was not entitled to stay execution upon an *ex facie* unexceptionable warrant upon mere unvouched averments of his own. Mr M'Neel reclaimed, and it then appeared that in the previous year a similar assessment and the same objection had been made, that the parties had on that occasion referred the case to Mr Smythe, the Secretary of the Board of Supervision, who had decided in Mr M'Neel's favour,‡ and that for that year the Paro-

* It is understood that this case has been appealed to the House of Lords.

† The mode of assessment adopted in Stranraer was the following:—"Such assessment shall be imposed as an equal per-centage upon the annual value of all lands and heritages within the parish or combination, and upon the estimated annual income of the whole inhabitants from means and substance, other than lands and heritages situated in Great Britain or Ireland."—8 *and* 9 *Vict. c.* 83, § 34.

‡ The case, as put to Mr Smythe by the agent of the Parochial Board, was as follows:—"Mr M'Neel was assessed on an income of £500, reduced, by his own

chial Board had allowed the deductions. The discussion on the reclaiming note was confined to the deduction claimed for interest on two heritable debts secured upon Mr M'Neel's estates in the counties of Edinburgh and Ayr; and Mr M'Neel argued that by "means and substance," the statute meant free income, not gross income, and that, as a party is clearly entitled to relief on account of the interest of heritable debt, such relief must be obtained in the parish where his means and substance are assessed, because interest of debt is not a deduction permitted by the statute in the assessment upon his land.* The Court, (Second Division), adopting Mr M'Neel's views, altered Lord Jeffrey's interlocutor, and found Mr M'Neel "entitled to deduction from his assessable income, from means and substance, of the interest of heritable debts due by him, at the rate paid thereon for the time."—*M'Neel* v. *Watt*, 18*th February*, 1848; *Jurist*, vol. xx. p. 247.

Statutes 2 *and* 3 *Vict.*, *c.* 42, *and* 7 *and* 8 *Vict. c.* 34.—*Prisons' Assessment—Mines within Burgh.*—Messrs Addie, Miller, and Rankin, tenants of an ironstone pit, in certain lands within the limits of the burgh of Airdrie, in Lanarkshire, were assessed, in respect thereof, under the Prisons' Assessment Acts, by the magistrates of the burgh, in the sum of £26, 13s. 4d. for the year 1845. This assessment not being paid, Mr James Gillies, collector of the burgh assessments, sued out a distress-warrant from the sheriff, and proceeded to distrain: whereupon Messrs Addie, Miller, and

showing, to £474, 11s., but he insisted on the annuities and interest of borrowed money (£265) being deducted. He does not say whether these burdens are heritably secured, and where; but I have reason to believe they are secured in Ayrshire and Edinburghshire, where he has heritable properties; at all events, they are not situated in this parish. It is not the custom here to deduct the interest of heritable debts from the income of parties assessed, as the heritable creditors, if resident in other parishes, could not be assessed on incomes so derived." The following was Mr Smythe's reply:—"I think the appeal in this case should be allowed, and that Mr M'Neel should be allowed to deduct the sums paid by him for annuities and interest of debts, from his income derived from means and substance. You say it is not the custom to deduct the interest of heritable debts from the incomes of parties assessed, because you cannot reach the heritable creditors if non-resident. The difficulty, however, of reaching the heritable creditors cannot be held to be a sufficient reason for assessing Mr M'Neel, if he is equitably entitled to relief. The heritable creditors are liable to be assessed for those bonds in the parishes in which they reside; and I conceive that, were you to assess the holder of an heritable bond who resided in Stranraer, it would not be held a valid plea for exemption, if he were to show that the debtor was assessed in another parish for the rents of the lands over which the bonds extended. A heritable bond forms, I think, part of the means and substance of the creditor, and (if that be admitted) it follows, that it ought to form a deduction from the means and substance of the debtor. Means and substance must be held to be clear net income."

* The 37th clause enacts, "that in estimating the annual value of lands and heritages, the same shall be taken to be the rent at which, one year with another, such lands and heritages might, in their actual state, be reasonably expected to let from year to year, under deduction of the probable annual cost of the repairs, insurance, and other expenses, if any, necessary to maintain such lands and heritages in their actual state, and all rates, taxes, and public charges, payable in respect of the same."

Rankin, presented a note of suspension and interdict in the Court of Session. The question at issue was, whether *mines within a burgh* are liable to assessment under the Prisons' Acts? The leading statute, 2 and 3 Vict. c. 42, has the following provisions:—"The amount of the sums to be assessed upon each county, including the burghs therein, shall be apportioned upon, and divided between the burghs and landward parts of such counties, according to the relative population of such burghs and landward parts respectively," § 39; "it shall be lawful for the Commissioners of Supply of any county . . . to assess the sums which shall be annually apportioned, as aforesaid, on the landward part of such county, according to the real annual value of the whole lands, teinds, fishings, mills, mines, minerals, . . . and pertinents, situated in the landward part of such county," § 42; "the portion of the gross amount of the foresaid estimated sums, which shall be annually apportioned by the Board on the several burghs, as aforesaid, shall be assessed by, or under the authority of, the magistrates of each burgh, on the annual value of property within the same," § 46; and "'property in burghs' shall extend to and include houses, shops, warehouses, mills, manufactories, cellars, gardens, yards, and all buildings and pertinents thereof," § 63. The amending statute, 7 and 8 Vict. c. 34, provides, (§ 29,) "That whereas doubts are entertained as to the interpretation of the expression, 'property in burghs,' in the construction of the first-recited act, be it declared and enacted, that, in the construction of the said act, 'property in burghs' shall extend to and include houses, shops, warehouses, mills, manufactories, cellars, canals, railways, gardens, yards, *and all lands, buildings, and pertinents thereof.*" The Lord Ordinary (Ivory) considering that, on a fair construction of the statute, mines were to be included within the term "property in burghs," refused the note with expenses, and the Court (First Division) unanimously adhered.—*Addie and Others* v. *Gillies*, 2*d March* 1848; *Jurist*, vol. xx. p. 292.

Lands' Clauses Consolidation Act—Investment of compensation-money for Land taken from Entailed Estate.—The Aberdeen Railway Company having taken, under the powers of their act, a portion of the entailed estate of Cowie, the amount of compensation was fixed, by statutory arbitration, at £5000, which was consigned in bank in terms of the Lands' Clauses Consolidation Act. William Innes, Esq. of Raemoir, the heir in possession of the estate of Cowie, made application to the Court for authority to invest this sum, until an opportunity of purchasing land therewith should occur, in a heritable security over the estate of Raemoir, which he himself held in fee-simple—the security to be in favour of himself and the other heirs of entail of Cowie. The Court (Second Division) granted the application; the Lord Justice-Clerk, in doing so,

observing, "that, after communicating with the other Division, the Court thought it the safer course to refuse the petition, there being no specialty whatever in the case; but that, after what had already been done under the authority of the Court,* they would authorise the transaction to be completed; declaring, however, that no such application would be granted in future."—*Innes, petitioner*, 8*th March* 1848; *Jurist*, vol. xx. p. 303.

Right of Ferry—Charter of Barony—Prescription.—The Duke of Montrose, as proprietor, and Andrew Blair, as his tenant, of the ferries on Loch Lomond, from Rowardennan and Inversnaid, in the county of Stirling, to Inveruglas and Portochoible, in the county of Dumbarton, presented a note of suspension and interdict against Malcolm M'Intyre, boatman, and others, with the view of preventing them from ferrying any person or thing across Loch Lomond at these ferries, or in their vicinity. The ferry of Rowardennan was claimed by the Duke in virtue of his titles to the contiguous lands on the Stirlingshire shore, which conferred "the privilege of the ferry and ferry-boat, and office of ferrying, at Rowardennan." But the ferry at Inversnaid was claimed by the Duke in right of a crown-charter on which he was infeft in the barony of Buchanan, and which contained no clause of ferry, but simply conveyed the barony, with pendicles and pertinents, and all privileges thereto belonging. The Duke proposing to prove prescriptive possession of these ferries, it was objected that, in the case of Inversnaid, there being no express grant of the right of ferry, his Grace had not shown sufficient title to which possession could be legally ascribed. The Lord Ordinary (Wood) decided this point in the Duke's favour. The boatmen reclaimed; whereupon, the Court (First Division) being divided in opinion, the opinion of the other Judges was taken, and ultimately the Lord Ordinary's interlocutor was adhered to, Lords Jeffrey and Ivory dissenting.—*The Duke of Montrose and another* v. *M'Intyre and others*, 10*th of March* 1848; *Jurist*, vol. xx. p. 317.

Landlord and Tenant—Act of Sederunt 1756—*Caution for Arrears and future Rents.*—In the year 1839, the late Sir Francis Mackenzie of Gairloch, by missives of lease, let the farm of Bishop Kinkell, in the county of Ross, to Alexander Mackenzie for a period of nineteen years, it being also stipulated that a certain extent of woodland should be added to the farm, and should be from time to time trenched, drained, and enclosed, by the landlord. The tenant brought an action in the Court of Session in 1846 against the successor of Sir Francis, Sir Kenneth Mackenzie, and his tutors,

* The necessary inquiries had been made as to the sufficiency of the proposed security, &c., and the deeds had been prepared.

alleging that the stipulations of the missive had not been fulfilled, and concluding for implement and damages. While this action was proceeding, Sir Kenneth, in November 1847, brought an action in the Sheriff-Court against the tenant, founding on the missive of lease and the Act of Sederunt 1756, and praying to have the tenant ordained to find caution for arrears of rent due by him, (£132, 18s. 2d.,) and for the rent for the five following crops; failing which, to flit and remove from the farm. The sheriff, before considering the defences of the tenant, ordained him to find caution for arrears and future rents as prayed for. The tenant thereupon, without finding caution in terms of this order, advocated the action to the Court of Session; *ob contingentiam*; but, as soon as the note was passed, the Lord Ordinary, upon the motion of Sir Kenneth, ordained him to find the caution required. The tenant reclaimed, and the Inner-House, (First division,) considering this case as essentially different from that of Cossar *v.* Home,* recalled the Lord Ordinary's interlocutor, and, reserving the question of expenses, remitted to him to proceed further with the cause in common form.—*Mackenzie* v. *Mackenzie*, 23d May 1848; *Jurist*, vol. xx., p. 369.

Statute, 8 *and* 9 *Vict. c.* 83—*Poor-Law—Constructive Refusal of relief.*—Christina Rice, a native of Ireland, was left a widow by the death of her husband, (also a native of Ireland,) on the 18th of June 1846, with two children, the one aged four years and two months, and the other one year and ten months. They resided in Glasgow, and both husband and wife had received parochial relief for some weeks before the above date from the City parish, but neither of them had obtained an industrial settlement there. Both of the children, however, were born, and had constantly resided in Glasgow. On the 14th of July 1846, the mother applied to the sheriff of Lanarkshire, under the 73d clause of the new Poor-Law Act, (8th and 9th Vict. c. 83,) stating the above circumstances, and alleging that she was unable to provide for her children in addition to supporting herself, and that she had applied for parochial relief on their behalf, but had been refused. The inspector of poor for the City parish of Glasgow admitted the truth of the statement as to her circumstances, but denied that she had been refused relief; while Christina Rice averred, in explanation, that when she applied for relief she was informed, that if she persisted in her demand, a warrant would be obtained to remove her and her children to Ireland. A proof upon this point was led, and the material facts which came out in evidence were, 1st, That, in the minute-book of the Parochial Board, were entered two payments of 2s. 6d. to Christina

* *Jurist*, vol. xix. p. 228; also, for a report of this case and the terms of the Act of Sederunt 1756, see *Journal of Agriculture* for July 1847, p. 70.

Rice, on the 25th June and 2d July 1846, with a note appended in each case, "To go home to Ireland," while the next entry was a payment of 1s. 6d. to her on the 16th July, being after the date of the application to the sheriff; and, 2d, That a gentleman, who called on her behalf at the office of the Parochial Board, was told by an assistant inspector that the Board had resolved, if she applied again, to send her to Ireland. This evidence the sheriff-substitute (Bell) did not consider as amounting to a refusal of relief; but the sheriff thought otherwise; and on a note of suspension being presented in the Court of Session against this decision, both the Lord Ordinary (Cuninghame) and the Inner-House (First Division) held, that the threat to send the mother to Ireland was, in the circumstances, tantamount to a refusal to afford relief to the children, and they refused the note with expenses.—*Willock* v. *Rice*, 9th June 1848; *Jurist*, vol. xx. p. 462.

Landlord and Tenant—Tenant at Will—Obligation to pay Meliorations.—In the year 1792, Donald Ross, who was tenant at will of a small possession and mill on the estate of Skibo, in the county of Sutherland, obtained from his landlord a written obligation to allow him "meliorations in case of his removal." In 1795, the estate was sold to Captain Dempster, by whom it was entailed. Captain Dempster was succeeded in the estate by his daughter, wife of William Soper Dempster, Esq.; and, in 1806, during her possession, her husband, by a written docquet, confirmed the above obligation. Mrs Soper Dempster died in 1810, when her interest, and that of her husband, in the estate ceased, and she was succeeded by her son, George Dempster, Esq., as next heir of entail, from whom Donald Ross obtained no obligation as to meliorations. Mr Soper Dempster died in 1830, but was not represented by his son. Donald Ross continued tenant at will under these several proprietors until his death in 1838, and his widow and executrix was tenant at will from that date till Whitsunday 1843, when she was removed from the premises. She then brought an action against Mr Dempster, the heir of entail in possession of the estate of Skibo, and the executors of Mr Soper Dempster, for £218, the amount of meliorations at the date of her removal. During the action, however, she abandoned her claim against Mr Dempster, and only persisted in it against his father's executors. It appeared that, at the death of Mrs Soper Dempster in 1810, the meliorations then due only amounted to £32, and this sum the defenders, as executors, admitted their liability for, and tendered payment. This tender was declined, the pursuer pleading—that, under Mr Soper Dempster's written obligation, his executors were bound to pay the meliorations up to the date of removal. The defenders pleaded—that their liability terminated when Mrs Soper Dempster's interest in the estate ceased. The Court, (First Division,) adhering to the

Lord Ordinary (Cuninghame's) interlocutor, found the defenders liable only in the sum which they had tendered.—*Ross* v. *Hawkins and Others*, 14th June 1848; *Jurist*, vol. xx. p. 471.*

Church Seats—Division of Church—Choice of Family Seat.—A new parish church, capable of containing 1000 persons, having been built in the parish of Polmont, in the county of Stirling, the cost of erection (£2000) was raised from the heritors, rateably according to their valued rents. The entire valuation of the parish was £6052 Scots, of which the Earl of Zetland's valuation was £1408, and J. G. Drummond, Esq. of Abbotsgrange's, £1234, being the two largest in the parish, and the valuation next in amount was £402. By the plan for seating adopted by a committee of heritors and the presbytery, the front of the gallery was divided into twelve pews, and of these Lord Zetland and Mr Drummond each claimed two, making thirteen sittings to each as a family seat. The other heritors objecting to this, application was made to the sheriff, and an advocation was subsequently brought to the Court of Session. The chief arguments of the heritors were, that Lord Zetland and Mr Drummond (who were non-resident) were only entitled to priority of choice of *one pew each* as a family seat, that they must take the pews as they found them, and that they were not entitled to have their size proportioned to their valuation. The Court (First Division) adhering to the Lord Ordinary (Cuninghame's) interlocutor, decided in favour of the claims of Lord Zetland and Mr Drummond, as being reasonable and equitable under the circumstances.—*Walker and Others* v. *Earl of Zetland and another*, 21st June 1848; *Jurist*, vol. xx. p. 499.

Landlord and Tenant—Singular Successor—Lease of Coals—Clause of Reference in Lease—Acquiescence.—James Donaldson, Esq., of Gartnavel, in the county of Lanark, let the coals in certain parts of his lands to James Carrick, for a period of twelve years from Whitsunday 1840. By the terms of the lease, the proprietor was entitled, in his option, to a fixed rent or a Lordship for each year, and he bound "himself, and his heirs and successors, to warrant" the lease to James Carrick, "at all hands and against all mortals, as law will." There were the usual powers to the tenant to work the whole coals in the lands, to make pits where convenient, &c., and there were *inter alia* the following special stipulations:—"If any other pits should be required than the two

* At advising this case, the Lord Justice-General remarked,—"The pursuer has allowed the case to take an unfavourable aspect for herself, by allowing the heir of entail to get off as she has done: for it seems to me that, if the heir of entail saw extensive and praiseworthy meliorations in the course of being made by his tenant on his property under his own eye, it would require very grave deliberation to decide whether that tenant was not entitled to reimbursement."

already in part sunk, then the tacksman shall have power to sink another pit or other pits as aforesaid, but only in such a situation or in such situations as shall have been previously approved of in writing by the said James Donaldson or his foresaids;" "and in case of any dispute or difference arising between the said parties respecting the true intent and meaning of these presents, or in any manner of way relating to the premises either during the currency of this lease or after the expiry thereof, all such disputes and differences shall be submitted and referred from time to time as the same shall arise; and the parties hereby submit and refer the same to the amicable decision, final sentence, and decreet arbitral of William Napier, engineer, presently in the employment of the said James Donaldson, and others, at Stevenston," "whose decision shall be final and binding on both parties." The coal worked from the two pits first opened, becoming nearly exhausted, at or about Martinmas 1844, Carrick applied to the representatives of Mr Donaldson (who was then dead) for authority to open a new pit, but they delayed giving it, as they were about to sell the estate. In March 1845, Mr Matthew Montgomerie, and others, having bought the property, Carrick applied to them for the requisite authority, which, after some correspondence, resulted in a refusal. Carrick then applied to the referee named in the lease, to investigate and decide the matters in dispute—claiming right to sink a new pit in a certain locality, and also damages from the loss of a proper pit since Martinmas 1844. In the proceedings that followed before the referee, the proprietors at first objected, that the clause of reference in the lease was not binding upon them, being singular successors, (purchasers,) but they also joined issue upon the merits. The referee ultimately found Carrick entitled to sink the pit claimed by him, and also awarded to him the sum of £120 as damage sustained by the landlord's refusal to give him the requisite permission. Upon this the proprietors raised an action in the Court of Session, to reduce and set aside the decreet arbitral, and whole proceedings under the reference, on the ground that the clause of reference in the lease was only binding upon the granter and his heirs, or, if binding on a purchaser as to special matters there enumerated, it was at all events *ultra vires* of the referee to construe the lease itself, which he had done. The Court, however, (First Division) adhering to the Lord Ordinary (Ivory's) judgment, assoilzied the defenders with expenses—considering both that the clause of reference here was available against a purchaser as well as against the granter and his heirs, and that the proprietors were barred from objecting to the referee's powers, by their acquiescence in the proceedings before him.—*Montgomerie and others* v. *Carrick and Napier*, 23*d June* 1848; *Jurist*, vol. xx. p. 504.

Sale—Cattle—Implied Warranty of Soundness—Chronic Disease

at time of Sale.—On the 17th of August 1841, James Brown, cattle-dealer at Roberton, in the county of Lanark, bought from William Boreland, cattle-dealer at Cample of Closeburn, in the county of Dumfries, for £11, (which was admitted to be a fair price,) a cow which had calved five days before. Three days after the sale she was removed by a servant of Brown's, and along with some other cows was driven to Edinburgh, a distance of nearly 60 miles, the journey being accomplished in 4 days. She was carefully driven and properly attended to, but from the first exhibited symptoms of not being well, gave very little milk, and arrived in Edinburgh with difficulty, although none of the other cows were distressed by the journey. On the day of her arrival, the 24th of August, she was sold to J. and W. Shaw, cattle-dealers, Edinburgh, by whom, on the following day, she was again sold to John Henderson, farmer, Nether Libberton, near Edinburgh. On the 1st of September Henderson returned the cow as unsound to J. and W. Shaw, in whose possession she died upon the 4th of September. Her carcase was examined by Mr William Dick, veterinary surgeon, who discovered the existence both of acute and chronic disease, the latter, in his opinion, of at least two months standing, although he considered the former as the immediate cause of death. In Mr Dick's judgment, the acute disease resulted from the chronic complaint, in conjunction with some additional cause, such as calving, cold, or exertion. The indications of illness exhibited on the journey coincided with the proper symptoms of the chronic disease detected by Mr Dick. J. and W. Shaw brought an action for the price of the cow against Brown in the Sheriff Court of Lanarkshire, and, after some litigation, judgment was pronounced against him. In this Brown acquiesced, but brought an action against Boreland (from whom he had bought the cow) in the Sheriff Court of Dumfriesshire for reimbursement of the price paid by him. Boreland's defence mainly rested upon the fact, that the death of the cow resulted immediately not from the chronic and latent disease, which existed at the time of the sale, but from the acute disease, which he alleged was caused by injudicious treatment after the sale; and he adduced two veterinary surgeons, who deponed that they considered the treatment to which the cow was subjected injudicious, and might have rendered the chronic disease acute, but they admitted that this treatment was common among cattle-dealers. The Sheriff-substitute, the Sheriff-depute, and, upon an advocation, the Lord Ordinary (Cuninghame) concurred in sustaining this defence; but Brown having reclaimed, the Court (First Division) unanimously altered the previous judgments, and found him entitled to repayment of the price of the cow with expenses.—*Brown* v. *Boreland*, 29*th June* 1848; *Jurist*, vol. xx. p. 537.

Entail—Statute 5 *Geo. IV. c.* 87—*Provisions under the Aber-*

deen Act.—Feu-duties and Minerals included in Estimate of "Rent." —The late Mr Moffat Wellwood, heir of entail in possession of the estate of Garvock, in the county of Fife, executed the necessary deeds for securing to his widow and his only daughter the provisions authorised by the Aberdeen Act, (5 Geo. IV. c. 87,) viz. to his widow, an annuity of "one-third part of the free yearly rent and value" of the estate, after deducting all burdens affecting the estate, "or the yearly rents and proceeds thereof;" and to his daughter, "one year's free rent" of the estate, payable "out of the rents and proceeds thereof," all as the "same should be ascertained at his death." Mr Wellwood died on the 25th of February 1847, and his widow on the 1st of August following. A question then arose between Mr Robert Scott Wellwood, who succeeded as heir of entail to the estate, and his predecessor's daughter, who claimed her own provision, and half-a-year's widow's annuity, due to her as her mother's executrix. Mrs Clarke, the daughter, contended that certain feu-duties payable to the heirs of entail, and certain coal-fields on the entailed estate, worked under a 19 years' lease, were to be included in estimating the "free rent" and "yearly proceeds" of the estate; while Mr Scott Wellwood took an opposite view, and presented a petition to the Court of Session, to have the provisions restricted accordingly. The coal was let for a fixed rent of £400 *per annum*, and a royalty which was stated to yield annually a very large sum. The Court (First Division) unanimously found that the feu-duties fell to be computed in estimating the amount of the provisions to the widow and daughter; repelled the plea that no part of the rent or royalty of the coal on the estate was to be so computed;* and allowed a minute to be lodged as to the proper amount of the said rent or royalty.—*Scott Wellwood* v. *Clarke*, 12*th July* 1848; *Jurist*, vol. xx. p. 555.

Landlord and Tenant—Sequestration—Farm arable or pasture. —Messrs Gavin and Anthony M'Clymont were tenants of the farm of High Riggend, in the county of Ayr, the property of Sir John Andrew Cathcart of Carleton, Bart. By the lease, the term of entry was declared to be Whitsunday 1845 as to the houses, meadows, grass and pasture lands, and at the separation of crop 1845 as to the arable lands, for which last a regular course of cropping was laid down; and the tenants were bound to pay an annual rent of £105, the first half-year's payment at Martinmas 1845, the second at Whitsunday 1846, and so forth thereafter. The rent due at Martinmas 1845 was paid, and that due at Whitsunday 1846 was nearly, if not entirely, settled; but the rent due at Mar-

* The Court indicated an opinion, that if the sum drawn from the royalty exhibited a great variance one year from another, it might be necessary, especially in regard to the widow's annuity, in order to ascertain the sum due for the year, to estimate the "proceeds" on an average of years.

tinmas 1846 not having been paid, and a creditor of the tenants having executed a poinding, the landlord, upon the 16th of November 1846, applied to the Sheriff of Ayrshire for sequestration of the whole stock, crop, &c., for the half-year's rent which fell due at Martinmas 1846, together with warrant of sale if the said rent was not paid, and also for sequestration in security of the current half-year's rent due at Whitsunday 1847; reserving to the landlord, if this last mentioned rent was not paid, to apply for warrant of sale for payment thereof. This application was granted, part of the effects sequestrated being corn reaped in the year 1846; but no sale took place immediately; and other sequestrations, on the same principle, were made in consequence of the non-payment of rent at subsequent terms. Ultimately a sale was advertised for the 3d of December 1847, whereupon the tenants applied to the Court of Session for suspension and interdict, pleading that the rent was forehand rent, and that the corn reaped in the autumn of 1846, (according to the ordinary rule in an arable farm, which this farm was, at least to a certain extent,) was only liable for the rent of the year from Whitsunday 1845 to Whitsunday 1846, which had been paid, and not for the rent of the subsequent year. The Lord Ordinary in the Bill-Chamber (Fullerton) refused the application, and the Court, (First Division,) after having obtained a report from Mr Girdwood, land-steward to the Marquis of Bute, that in his opinion the farm was, "in its present state, essentially a pasture farm," adhered, and pronounced an interlocutor finding "that the farm in question" was "not an arable but a pasture farm," and "that the sequestration complained of" was, "therefore, not objectionable, in respect of its including the small portion of corn in question, although happening to be of the first crop reaped after the tenants' entry, while the sequestration" was "for his second year's rent," but that no expenses were due to either party.—*M'Clymont* v. *Cathcart*, *14th July*, 1848; *Jurist*, vol. xx. p. 557.

THE FARMERS' NOTE-BOOK.—NO. XXII.

Amount of Species of Animals and Plants, with occasional remarks on their properties and geographical distribution. By the Rev. JAMES DUNCAN, M.W.S.—The careful and laborious investigations of travellers and naturalists, in almost every quarter of the globe, may now be presumed to have made us acquainted with the vast majority of the plants and animals which inhabit it. Extensive regions, it is true, still remain altogether unknown in this point of view, and others have been but partially explored; but, by forming a comparative estimate of these, from data which may be pretty

safely depended on, we may arrive at a close approximation to the actual amount of the species which people the earth's surface. How vastly do their numbers surpass the notions that were formerly entertained of them; and how would the early naturalists, even of the era of Ray and Linnæus, be astonished at inspecting the contents of a modern *systema naturæ!* But, in the want of any work of that kind, in any degree approaching to a state of completeness, it is often very difficult to obtain accurate information on this subject, and the most grievous errors are frequently made in regard to it. The requisite information is widely scattered, and can only be obtained from works which are not generally accessible. As an instance of the serious mistakes that are frequently made on this subject, we may refer to a recent work of Dr Cumming of London, on the Christian Evidence. He is endeavouring to show, in opposition to the opinion of infidels, that the ark was of sufficient dimensions to contain all the animals that were preserved from the deluge. "Now, Buffon has stated," he adds, "that all the four-footed animals may be reduced to 250 pairs, and the birds to a still smaller number;" and, proceeding on this estimate, he concludes that the ark would have held them, as well as the food requisite for their support, with the utmost ease. Now the amount of the species of quadrupeds and birds, as at present ascertained, instead of being 500 as here stated, is at least 9,500; and the number of individuals, if in pairs, would of course be double that amount; and this is a mere fraction of the animal kingdom.

In the following enumeration, we shall state the numbers of the respective classes as they have been determined by naturalists of competent authority; and, where there is reason to believe that all the species are not yet known to us, to form a probable conjecture as to the amount actually existing in nature.

Among animals, the mammals, to which class we ourselves belong, are entitled to the precedence. They consist chiefly of quadrupeds, but include also the cetacea, or whales, which were long erroneously regarded as fishes, (we believe that they are still so considered in law,) with which they have nothing in common but the element which they inhabit. It was thought a magnificent idea when Ray, as far back as 1690, estimated the amount of *beasts*, as he called them, including *serpents* under that name, at 150; adding his belief that "not many of any considerable bigness, in the known regions of the world, had escaped the cognisance of the curious." The amount of this class is now at least 1500; and although our acquaintance with the species is probably more complete than in any of the other classes, we have still no reason to conclude that all of them have fallen under our observation. Only 61 land species of mammalia occur in Britain; a good many cetacea (about 14) are found on our coasts, but many of these are

only occasional visitants. The English hare, the squirrel, dormouse, polecat, and mole, do not extend to Ireland. Neither is the water-rat, nor any other species of Arvicola, found in that island; and although red-deer occur, the roebuck is wanting. The largest of our native quadrupeds is the red-deer, the smallest the harvest-mouse. It is curious to reflect of how little utility, in an economical point of view, our native mammalia are to us. Nearly all our domesticated quadrupeds, on which we are dependent for food, convenience, and comfort, are derived from other countries; and this observation is not confined to them alone, but extend to some of the other classes.

Ray estimated the number of birds at 500; it is now the general belief of ornithologists that it does not fall short of 8000. Of these about 500 are natives of Europe; and the habitual residents of Britain are 277; but, if we include casual visitors, the amount will exceed 300. The tallest living bird is the African ostrich, although that was greatly exceeded by the New Zealand deinornis —which there are some faint grounds for supposing to be yet living—fossil specimens of that feathered giant being found 10 feet in height. At the opposite extremity of the scale, in respect to dimensions, may be placed the humming-birds, those ornithological jewels, one of which is not larger than our common yellow-banded humble-bee. All our most useful domesticated birds are from foreign countries, excepting ducks, geese, pigeons, and one or two others. It is an interesting fact, that all the birds of this country are common to it and the Continent of Europe, with the exception of red grouse, which is the only species we can claim with certainty as exclusively our own.*

Reptiles, fortunately, as some will be inclined to think, are not very numerous; still they amount altogether to about 1500. Only about a dozen species exist in Britain; and of these the common viper is the only one truly venomous. The class is represented in Ireland by only 5 species; and there are many other instances of an anomalous kind in their distribution. If originally disseminated from a certain point, or centre of creation, as it is

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* Even this has been recently called in question. A northern naturalist expresses it as his opinion, that there is an Icelandic species identical with ours. This bird becomes white in the winter like a ptarmigan; but this is not necessarily a specific distinction, but may possibly be the result of geographical position. Besides the red grouse, Mrs Somerville, in a recent work on physical geography, regards the pied and yellow wagtails, and what she calls the English starling, as peculiar to Britain. But the yellow wagtail is a bird of passage, and must exist somewhere during its absence from our island. The English starling, as distinct from the common starling, a bird very widely distributed, is unknown to naturalists. This is one of the instances, among many others, in which it is to be wished that this distinguished writer would mention the authority on which her statements rest. She commonly gives the results of her reading without reference to the authors from whom they are derived.

called, we may suppose the last undulation of the propulsive wave to have exhausted its strength when it reached Britain, at that time forming a continuous portion of the Continent. By supposing Ireland separated from Britain, as now, by an intervening channel, the further progress of these animals would be effectually arrested, as they have but little power of overcoming natural obstacles. Hence the toad is unknown in Ireland, and the frog, though now frequent, is supposed to have been introduced. No species of snake or ophidian reptile has hitherto been found there.

Of all vertebrated animals, there is reason to believe that the class of fishes is the most extensive; upwards of 8000 species having been described by naturalists, and continual accessions are making to that number. Of these 253 inhabit the fresh waters of Britain, and the surrounding seas. The fact of certain species of fishes constructing nests, and manifesting the greatest parental affection for their young; of others leaving the water at times, and moving about the land; the existence of a peculiar organ, called a lymphatic heart, in the tail of the eel, which has a pulsation of its own independent of the real heart—are among the most interesting discoveries that have lately been made in the history of this class.

Recapitulating the numbers stated, we thus find that the entire amount of known vertebrate animals is 19,000, and of these we have about 603 inhabiting Britain.

These numbers are, however, insignificant when they come to be compared with the mighty hosts of invertebrate animals. Indeed, we cannot attempt anything like a complete enumeration of these; for however much some of them have been studied, the boundaries of the field cannot be said to have been traced with any degree of accuracy. One of the best known is the class of insects: of these, specimens of upwards of 100,000 different species are preserved in cabinets; more than twice that number are known to naturalists, and probably not fewer than 400,000 exist in nature. Of the great classes of molluscous animals, including shell-fish, cuttle-fish, snails, and suchlike animals; of the articulated animals, consisting of leeches, earth-worms, lobsters, crabs, &c.; and the radiata, comprehending star-fish, polypi, corals, madrepores, sponges, &c.—it would be difficult to give any general enumeration of species which could be relied on for accuracy. An approximation, however, may be made to the amount of British species in some of these classes. The number of insects which have been catalogued and described, and many of them figured, as indigenous to Britain, is about 12,000. Dr Johnston, in his beautiful and valuable, though discursive and diffuse work on British zoophytes, describes 159 of these animals. Collections of the shells of the mollusca are frequently made, amounting to several thousands. Mr Denny, in a work on British pediculi, enumerates 237 of these animals. Professor Eschricht of Copenhagen expresses his belief that the number

of parasitical animals—that is, such as live in and upon other animals—is as great as all the others put together. Infusory animals seem to multiply without end; and the dimensions of the smaller kinds may be judged of from this—that Leeuwenhoeck calculated that 10,000 of them might be held within the bulk of a grain of sand! The most impalpable dust, carried about by the winds, and occasionally falling on vessels far out at sea, has been often found, under the powerful glasses of Ehrenberg, to consist of infusory animals. "In a small quantity which I sent him," says Mr Darwin, "of this dust collected at sea, he ascertained no less than 67 different organic forms." The same individual has found these animals in fog, rain, and snow,—in peat-earth, many feet below the surface of the ground; they have likewise been ascertained to exist in ice. Entire mountains, and even chains of mountains, are formed of minute shells—so minute that 10,454 have been counted in an ounce weight. Chalk, too, is often almost wholly composed of these minute beings.* Such is what Cicero calls the insatiable variety of nature. The more we investigate her productions, the more have we occasion to wonder at their number and diversity: however far we advance, new objects, fresh views, are continually opening before us; and the prospect is bounded, not by its actual line of termination, but by the incapacity of our senses to penetrate further. For what reason have we to suppose that that microcosm—that world of animated atoms which the microscope reveals, and which we, estimating them by an arbitrary standard, are accustomed to call minute—what reason have we to suppose that these form the last links in the chain of living beings? Every logical induction tends to an opposite conclusion, and to impress upon us the belief that these animated entities are continued, in regard to dimensions, in a descending scale, to a distance where our senses, with all the aid that art can lend, are utterly unable to follow them; and that in these the same master-hand, "to whom an atom is an ample field," equally manifests its wisdom and its skill, as in the largest organised structures which exercise our senses and excite our admiration.

When we reflect that plants form the green vesture which covers the earth, wherever we turn our eye; that they vary with every degree of latitude, from the ice-bound regions of the north, where the rein-deer moss, dwarf birch, and creeping willow, struggle to maintain a precarious existence on the very outposts of the animated creation, to the zones lying between the tropics, where the joint effects of heat and moisture—the two great agents in promoting the growth of plants—produce a teeming exuberance of vegetation which it is difficult to form an idea of—not only covering

* See Somerville's *Physical Geography*, vol. ii.

the surface of the ground, but parasites, and creepers, and epidendrons, heaped up, as it were, upon each other, till they form a lofty and dense mass of mingled stems and foliage, fruit and blossom, which even the vertical rays of a tropical sun cannot penetrate, and which often form continuous platforms for hundreds of miles together, on which multitudes of animals, some of them even of large size, habitually dwell, without ever descending to the ground: when to this it is added that the waters of the ocean abound in plants,—that the stems and branches of trees, and the surfaces of rocks, are usually covered with them, and that decaying vegetable matter soon supports a miniature vegetable forest of its own,—these considerations will at once enable us to perceive that the number of species composing the vegetable kingdom must necessarily be very great. A good many years have now elapsed since Humboldt estimated the number of known plants at 44,000. In a beautiful work, entitled the "Vegetable Kingdom," published about three years ago, Professor Lindley enumerates 82,606 species. Making allowance for such as have been since discovered, as well as such as may have escaped his observation, we may estimate the number of known plants at 100,000. But even this number, vast as it may seem, must be greatly short of the reality; for there are many extensive countries, almost unknown to us in a botanical sense, from which rich contributions may yet be expected. The interior of China, the central regions of Africa, the inland portions of many of the great islands of the Pacific Ocean, and numerous districts of South America, are fields which have hitherto remained almost untouched. Mr Loudon calculated, a good many years ago, that about 27,729 phænogamous, or distinctly flowering plants, have been introduced into Britain, from all quarters of the world, and cultivated there; and 2859 cryptogamous species, or such as have a minute and inconspicuous inflorescence. The flowering plants originally natives of Europe have been reckoned at 8000. Britain has 1500 indigenous phænogamous plants; the cryptogamous species are at least double that amount, there being no fewer than 1400 fungi, and nearly 400 mosses.

Of this vast assemblage of plants constituting the vegetable world, it is interesting to observe the relative numerical proportions of the different tribes, and their geographical distribution, for which Dr Lindley's work affords ample materials. Lowest in the scale of organisation are the algæ, living in water or very damp places, some of them appearing to partake alternately of a vegetable and animal existence, and seemingly obliterating the line of demarcation which was supposed to separate these two kingdoms. Some of them (the brittleworts) form the green slime that gathers over damp glass, stones, or shaded garden walks, springing up, as it were, spontaneously; and, when dried, they crumble down into small particles, as if they possessed the attributes of the mineral

kingdom as much as of the vegetable. These plants are of no direct use to man. Some of the confervas are capable of living in thermal springs, in a temperature of 117° Fahr. It is to a plant of this tribe, *Trichodesmium erythræum*, that the Red Sea owes its name, the origin of which has been so much disputed. "On the 8th July 1843," says M. Evernor Dupont, "I entered the Red Sea by the straits of Babelmandel, on board the Atalanta steamer. On the 15th, the burning sun of Arabia suddenly awoke me with its brilliancy, unannounced by the dawn. I was leaning mechanically out of the poop windows, to catch a little of the fresh air of night before the sun had devoured it, when, imagine my surprise to find the sea stained red, as far as the eye could reach, behind the vessel. If I was to attempt to describe this phenomenon, I should say that the surface of the ocean was entirely covered with a close thin layer of fine matter, the colour of brick-dust, but slightly orange. We passed through about 256 miles of this red plant." The fucaceæ, or seawracks, are the most conspicuous plants of this tribe, and these, along with the Ceramiaceæ, closely allied to them, amount to 1134 species. Some of these are the longest vegetable productions known. A lessonia is frequently 30 feet in length, with a trunk as thick as a man's thigh; and the fronds of *Macrocystis pyrifera* are said to be from 100 to 1500 feet in length.

The great tribe of Fungi probably exceeds 4000 species; and of these, as has been already intimated, Britain possesses a large proportion. Some of these plants grow with greater rapidity than any other vegetables, and they are greatly influenced by the state of the atmosphere, often springing up after storms, and speedily acquiring considerable dimensions. A curious fact in their distribution is, that very distant countries, when the climate is at all similar, produce nearly the same kinds. Thus a large proportion of the European species grow also in America, and conversely. They are well known to be much used for food, particularly in Australia. A few of them are strongly phosphorescent, and illuminate the mines and caves in which they grow with a very beautiful light.

Lichens, which cover rocks and walls in the form of thin crusts, form foliaceous patches on the stems of trees, or hang from the branches in hoary tufts, are likewise a numerous tribe—not less than 2400 strong. Some of them are somewhat nutritious, such as Iceland moss, Sticta pulmonaria, and a few others. Tripe de roche, on which Canadian hunters, and occasionally adventurous travellers from our own land, are forced to subsist, is the name of various kinds of Gyrophora. But perhaps the most useful plant of the whole tribe is the Cenomyce rangiferina, the winter food of the Reindeer—a plant found abundantly on most of the moors of Scotland.

Mosses, of higher organisation than the preceding tribes, and one

of the most interesting of the great cryptogamous section, amount to upwards of 1113 species. They are most numerous in temperate and even cold regions, one of their obvious uses being to protect the roots of other plants from the severity of the climate. "They are among the first vegetables that clothe the soil with verdure in newly-formed countries, and they are the last that disappear when the atmosphere ceases to be capable of nourishing vegetation. The first green crust upon the cinders of Ascension consisted of minute mosses: they form more than a quarter of the whole flora of Melville Island; and the black and lifeless soil of New South Shetland is covered with specks of mosses struggling for existence. How they find their way to such places, and under what laws they are created, are mysteries that human ingenuity has not yet succeeded in unveiling." *

The ferns of Britain, although not inconspicuous objects in our indigenous vegetation, from the number of individuals, and the plume-like elegance of their fronds, are very inconsiderable in respect to the amount of species, as they do not exceed 50. The foreign species are not more remarkable for their numbers—at least 2020 species—than they often are for their striking and beautiful appearance. If we imagine an immense tuft of some of our common aspidiums (say *A. dilatatum*, *A. cristatum*,) with the fronds much enlarged, elevated to the summit of a gracefully tapering stem 30 or 40 feet high, we will form some idea of the arborescent ferns of the tropics, although the latter are even more light and feathery. Although arborescent ferns are found as far south as Van Diemen's Land and New Zealand, nearly in 46° south latitude, yet they do not occur beyond the northern tropic. Resembling palms in their general aspect, they form even a more characteristic feature than these in the vegetation of a tropical landscape.

The grasses and sedges perform a most important part in the economy of nature: they form the chief portion of the verdure which covers the earth, particularly in the more northern countries; and the inhabitants of these countries, both man and beast, are indebted to them for their most valuable supplies of food. Generally of small size, they effectually make up for this by their social habit, and the immense number of the species and individuals. According to Lindley, they constitute nearly a twelfth part of the described species of flowering plants, and at least nine-tenths of the number of individuals composing the vegetation of the world. These two tribes united contain no fewer than 5800 species—the grasses amounting to 3800, the sedges (cyperaceæ) to 2000. The British species of grasses are 120, the sedges about 90. Although not their metropolis, grasses occur under the equator, and they extend

* Lindley's *Vegetable Kingdom*, p. 67.

as far north as Spitzbergen. In the south of Europe, a kind of Poa ascends nearly to the snow line; and others of the same genus, as well as Festucæ, reach the same altitude among the Andes. Their geographical range is therefore most extensive. It is only in temperate countries that they form a continuous turf, composing green meadows and pastures, and clothing hills with a verdant carpet, which excites the admiration of the natives of torrid zones, where such a feature never appears, the grasses growing there dispersedly among the other plants. This difference is apparent even in the south of Europe. The sedges are much less nutritious, containing little fœcula and sugar; but they are highly useful in northern countries, and the Lapland species are said by Humboldt to be equal to grasses in their feeding qualities. Another species is used in India for making mats, with which the floors of rooms are covered.

In the geographical distribution of the classical species of Papyrus, (*P. antiquorum*,) a plant of this tribe, great changes must have taken place in recent times. The traveller no longer observes its elegant stem and tufted head, fringing, as with a grove of miniature palm-trees, the margin of the once mysterious Nile. And, as if associated with it in some of the conditions of existence, as it is in historical celebrity, the sacred Ibis is also said to have deserted the shores of the seven-mouthed river! Both have retired to the far-extending marshy banks of lake Menzaleh, where they find a habitat better adapted to their respective natures. Yet there can be no question that the Papyrus was formerly abundant along a considerable part of the river's course. It was from the Nile that the Romans obtained their principal supply of writing material, and the plant afforded one of the characteristic epithets which their writers applied in such profusion to this poetical stream — it was "Amnis papyrifer;" and we read of "Nili alba tabula," "papyriferi septemflua flumina Nili." So plentiful was it that the inhabitants were accustomed to make boats of it; hence the "naves papyracias Nili." It was in one of these paper-rush boats, or baskets, as they might be called, that Moses was exposed; and it is not improbable that it was on this plant that he afterwards wrote his Pentateuch. Yet, though they appear to have obtained the plant principally from Egypt, the Romans had it growing much nearer them; at all events, it is found in the present day in Sicily. One of the branches of the Anapus was formerly named Papyrus; and we are informed by a gentleman who lately visited that country, that the Papyrus grows in considerable quantity in the small river Cyane, a tributary of the Anapus. There is a manufactory at Syracuse, on a small scale, for preparing the article as a writing material, it being in some request as an object of curiosity. The plant also grows in Syria, on the Euphrates and the Jordan, in the Isle of France, and in Madagascar.

It may excite surprise to assert that the plants just spoken of, with which we are so familiar in the humble form of grasses, are very nearly allied to the chiefs of the vegetable world—the princely palms. "The inflorescence of grasses," says Dr Lindley, "may be considered to be the same as that of palms, the floral envelopes of the latter taken away, and only their bracts remaining; and the leaves are formed upon exactly the same plan, with this difference only, that those of the grasses are undivided." The traveller southwards first meets with a representative of this family, the chæmerops humilis, near Nice, latitude 43°–44° N.; but they never form an important feature in the European landscape. In Syria, the date-palm seems to have been rather plentiful in former times. In the coins of Vespasian, Judæa is typified by a disconsolate female seated under a palm; and they are often alluded to in Scripture. But they are now very scarce in Palestine. It is not till we reach tropical regions that we meet with forests of these noble trees. Some of them have slender, graceful trunks, 500 feet long; some grow in groups; others shoot up slender stems into the air singly; and others exhibit a thick and towering trunk to the height of 180 feet. The leaves of some of the species are from 20 to 30 feet wide. One species, Alfonsia amygdalina, has been computed to have 207,000 flowers in a spathe, or 600,000 on a single individual; another bears 8000 fruits in every bunch! Von Martins, who has studied this group of plants more carefully than any other botanist, estimates their number at 1000 different species.

The conifers, including the pines, larches, cedars, &c., so universally important to man for the value of their timber and other properties, are not a very numerous tribe, the amount of species not exceeding 100. The yews amount to 50; birches and alders to 65; poplars and willows to 220. Of the latter, Britain possesses about 67 species; among others Salix herbacea, seldom found below an elevation of 2000 feet, and flourishing on the summit of Ben-na-muich-duich, considered to be 4390 feet above the sea. Salix arctica and polaris are the most northern woody plants known. The Corylaceæ or Mastworts, including the oak, hazelnut, beech, and Spanish chestnut, amount to 265 species.

Scarcely any tribe of plants exceeds the leguminosæ in importance, whether we regard the amount of species, the immense size of some of the arboreal kinds, or their utility both to man and animals. The entire amount is 6500; of these the mimosæ constitute nearly a sixth part, and the lotæ nearly a half. They are most numerous in the equinoctial zone, and diminish rapidly towards the poles: in Britain we have 65 native species. Some of the locust-trees of the western world are among the largest and oldest vegetables known. Martins represents them as occurring in Brazil of such dimensions, that fifteen Indians, with outstretched

arms, could just embrace one of them. At bottom they were 84 feet in circumference, and 60 feet where the boles became cylindrical. He concluded, by counting the rings, that they must belong to the age of Homer; at the most moderate estimate, they must date as far back as the time of our Saviour.

The solonaceæ, or night-shades, comprise 900 species, of which we have only five in Britain. The genus Solanum has only two British representatives, S. dulcamara, a pretty climbing shrub, found occasionally in hedges; and S. nigrum, with an herbaceous stem, white flowers, and black berries. Both these plants, like the rest of the tribe, are strongly narcotic. The question is often asked, why the potato (one of the solanums) is exempted from the noxious qualities of its congeners? The proper answer to this inquiry was first given, we believe, by De Candolle. It is the only one of its tribe which produces tubers on the roots; and these, from their structure and mode of growth, receive no portion, or at least not so much as to be injurious, of the poisonous ingredients. These, however, exist in the other parts of the plant, and were we eating the fruit, properly so called, or the leaves, we should find that they partook of the general properties of the night-shades. In fact, an extract of the leaves of the common potato is a powerful narcotic, ranking between belladonna and hemlock. Having been so long familiar with the potato in a cultivated state, it is interesting to be acquainted with its appearance in its native localities and unaltered condition, the more especially as recent events have given us some reason to fear that we may have again to recruit our present varieties by having recourse to the original stock.

The wild potato, say Mr Darwin, grows on these islands (Chonos Archipelago) in great abundance, on the sandy, shelly soil, near the sea beach. The tallest plant was four feet in height. The tubers were generally small, but I found one of an oval shape, two inches in diameter. They resembled in every respect, and had the same smell as English potatoes; but when boiled they shrunk much, and were watery and insipid, without any bitter taste. They are undoubtedly here indigenous; they grow as far south, according to Mr Low, as lat 50°, and are called aquinas by the wild Indians of that part: the Chilotan Indians have a different name for them. Professor Henslow, who has examined the dried specimens which I brought home, says that they are the same as those described by Mr Sabine from Valparaiso, but that they form a variety which by some botanists has been considered as specifically distinct. It is remarkable that the same plant should be found on the sterile mountains of Central Chili, where a drop of rain does not fall for more than six months, and within the damp forests of these Southern islands.*

The potato is sometimes said to give out a vivid light, when in a state of putrefaction. Dr Lindley mentions an instance in which an officer on guard at Strasburgh thought that the barracks were on fire, in consequence of the light thus emitted from a cellar full of potatoes.

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* *Journal of Researches into the Natural History and Geology of the Countries visited during the Voyage of H.M.S. Beagle, round the World*, p. 285.

The plants of the nettle (urticaceæ) and spurge tribes (euphorbeaceæ) amount to 2700 species, many of which are possessed of singular properties. The former is represented in this country by only four species, three of which are nettles properly so called. The stinging properties of some of the foreign species are very formidable. One of them, U. urentissima, or devil's-leaf, as it is called by the natives, is said at times to occasion death; and when it falls short of this, the effects sometimes last for a year. A French gentleman thus describes the effects of U. crenulata, an East Indian species:—

One of the leaves slightly touched the three first fingers of my left hand; at the time I only perceived a slight pricking, to which I paid no attention. This was at seven in the morning. The pain continued to increase; in an hour it had become intolerable; it seemed as if some one was rubbing my fingers with a hot iron. Nevertheless there was no remarkable appearance—neither swelling, nor pustule, nor inflammation. The pain rapidly spread along the arm, as far as the armpit. I was then seized with frequent sneezing, and with a copious running at the nose, as if I had caught a violent cold in the head. About noon I experienced a painful contraction of the back of the jaws, which made me fear an attack of tetanus. I then went to bed, hoping that repose would alleviate my suffering, but it did not abate; on the contrary, it continued nearly the whole of the following night—but I lost the contraction of the jaws about seven in the evening. The next morning the pain began to leave me, and I fell asleep. I continued to suffer for two days; and the pain returned in full force when I put my hand among water. I did not finally lose it for ten days.

Of the spurge tribe there are 120 European, and 16 British species. The euphorbias are well known for their milky secretions: many of them are most dangerous poisons, while others afford most useful medicines.

Such are the proportions which a few of the principal natural families bear to the entire amount of known vegetables. To treat of them all, even in the same cursory manner, would require more space than can at present be afforded; and I shall, therefore, take leave of the subject with a brief view of the notions that have been very recently advanced respecting the mode in which the British Islands have been colonised by vegetables. These views originated with Messrs Watson and Forbes, and are at least ingenious, if not altogether satisfactory.

The British Islands contain not a single plant which is peculiar to them; they are all common to them with the European continent. A single species, Eriocaulon septangulare, a native of North America, has been found among the Western Hebrides, brought thither, there can be little doubt, by the gulf stream. As Britain cannot, therefore, be regarded as a centre of vegetation, it must have been colonised by plants from the continent of Europe, and the authors above referred to, endeavour to account for its present flora by supposing a series of successive migrations from different parts of the Continent. The climate of the south-west of Ireland is peculiarly mild, and we there find about a dozen plants which

are natives of the Asturias in the north of Spain, whence they supposed to have migrated. The mountains of Scotland, Cumb land, and Wales, present a peculiar vegetation, analogous to t of the Alps, Lapland, Iceland, and Greenland. But by far greater number of the plants found in England, and the lowla of Scotland, are the same as those found in Germany and the no of France, and it is from these countries that the chief vegeta invasion has been made. A certain proportion of these have b unable to surmount the obstacle presented by the Irish Chan and are not, therefore, found in Ireland. These facts and appe ances, in the distribution of plants, have hitherto been accounted by considering them the natural consequences of the all-powe influences of soil and climate. But Mr Forbes goes back in series of geological formations, and carries us to a period when last tertiary formations were deposited in the bosom of a sea wh covered a great part of the south of Europe and north of A When the newly-formed lands were raised above the sea, tl formed a vast continent, comprehending Spain, Ireland, and a p of the north of Africa, with some of the adjacent islands. T great continent was afterwards immersed, when a period of c succeeded, during which the Arctic migration of plants took pl to the mountains of Scotland and England. But we may giv short *resumé* of these views in the words of M. Martins:—

These islands have been peopled by numerous colonies departing successi from continental Europe, from the period of the medium tertiary formations to own. When a vast continent extended from the Mediterranean regions to British islands, the plants of Asturias and Armorica peopled the south of Engl and Ireland. To this period succeeded the glaciary period, during which the l was immerged to the depth of about 450 metres. This is the epoch of the mi tion of the Arctic plants which still inhabit the summits of the mountains of S land. When these lands emerged anew, England was united to France, the ten rature being the same as it is now. Then the grand German invasion took pla it absorbed, so to speak, all the rest, and left only feeble remains of them. T while the Asturian plants, those of the south, are reduced to a small numbe species, confined to the south-west of Ireland, the hardy vegetables of the no completed their conquest, and took possession of the ground occupied at a l period by a warrior race, emanating from the same regions. This colonisation c pleted, England became separated from the Continent.*

The Potato—its ridge-and-furrow culture.—By Mr TOWE Author of "The Domestic Gardener's Manual."—A recurrence the disease—now in the fourth consecutive year—and with degree of violence which could not have been anticipated after convalescence or abatement of symptoms of 1847, naturally le to serious reflection. Theory is evidently at fault; curative remed are deceptive. Meteorology has been appealed to, yet the fact can be doubted or impugned, that, be the phenomena or the natu exciting agencies what they may, the potato of former years gr

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* *Bibliothèque Universelle de Genève*, June 1848, p. 102.

flourished, and yielded abundant and healthy crops. So far there has been "nothing new under the sun." But now disease seizes the plant under every circumstance and situation; its attacks are sudden as unexpected; and those very appearances—I allude particularly to the peculiar beauty of the plants till the end of last June, those promises of abundance—became, as it proved, the actual precursors of mischief. The question then suggests itself—Do reasonable hopes remain that the cultivation of the tuber, on the broad scale, will lead to any thing but perplexity and disappointment?

Believing, as I do, that the constitution of all the *later* varieties for winter store is tainted—vitiated by the disease—I must consider the attempt to be, at the least, doubtful; and, so far as the nation had plenty of food before the cultivation of the potato became general, it would be prudent to cultivate kohl-rabi, swedes, parsnips, carrots, and beet, far more extensively in gardens, for winter supply, the nutritive quality of which would be much enhanced by mashing-up with any one of those roots, after it was boiled or steamed till tender, a table-spoonful of sound oatmeal with the quantity used at a meal. But as it appears that, under altered circumstances, potatoes are and can be grown to perfection, it becomes a public duty to allude to a practice heretofore quite successful, the course of which it will be the office of this article to describe.

I would not poach upon any person's manor, and, therefore, every sentence which I borrow will be honestly acknowledged. The *personal* knowledge I claim has been derived from actual practice, in several counties, during a course of more than twenty-five years: hence I may be qualified, in some degree, to judge of results under a variety of circumstances; and I therefore am justified in declaring, that the mode of cultivation adopted by Mr James Cuthill of Camberwell has been eminently successful in every respect—particularly in the present year, (1848)—so much so that I am myself preparing a plot of ground for 1849, sufficiently extensive to determine, by actual experiment, the value of the process, in land very dissimilar to that of Mr Cuthill. It is a free blackish earth, which naturally is about two feet deep, upon a bed of sandy gravel, and abounding with fibrous vegetable matter. In it, rhododendrons, kalmias, some native heaths, and other fine-rooted plants, will grow and thrive. It is not a heath or moor soil, neither is it at all a binding loam; there are few vegetables which fail to grow luxuriantly in it; yet it certainly is deficient in alumina and calcareous matter, in which constituents I believe that the earth of Mr Cuthill's garden abounds.

While is is admitted that the *earliest* potatoes have, in some instances, been partially assailed by the prevailing disease, it is quite certain that those later sorts, which are grown for winter store, have on every occasion suffered most severely. Among the ash-

leaved kidneys, grown by me, which were planted in January
February last, not one spot of disease was perceptible upon eit
leaf, haulm, tubers, or their connecting processes; all the crop
dug and consumed by the first week of August. But, a
always happens, a few stray tubers were left in the soil. Som
these have been turned up so completely sound as to be saved
seed. Others have vegetated; and the young plants now in
garden are healthy and verdant, while every leaf and stalk of s
late varieties are entirely dead. I allude to these facts in the
sent tense, as being of actual occurrence at this time, (Sept. 2
and by virtue of them, connected with others of a similar nat
I feel authorised to recommend every gardener, amateur,
farmer, who intends to plant in 1849, to employ, without except
those varieties only which ripen perfectly before the middle
August, rejecting even the estimable "shaws," unless that vari
of them which is found to mature its tubers in our southern co
ties by that period. Having thus premised, I shall, without
ther delay, present the reader with copious extracts from
Cuthill's pamphlet, which was "dedicated by permission" to
able and excellent friend to agriculture, James Smith of Deans

Mr Cuthill commences by expressing his belief that the const
tion of the potato has been much weakened, by receiving the s
protection during the mild winters of late years as had been gi
to them in seasons of more severity; so that, by the time spr
has arrived, they have become so grown and matted together
it has been with great difficulty they could be separated; an
may be safely said that the constitution of a tuber, which has b
subjected to such treatment, will certainly be more apt to rec
injury from any noxious atmospheric influences which may prev
Without insisting upon the actual existence of any atmosph
epiphytic, (this term I would substitute for *epidemic*,) the c
clusion appears to be inevitable, that potatoes in the stores h
been treated in a manner to which no other plant has been, or e
can be, subjected—unless we except the Jerusalem artichoke, wh
does not protrude tuber-bearing processes, but collects its prog
in clusters round the base of the main stem. Hundreds of varie
have been lost to the community; and those at present in use app
to be essentially different from the sound, flavorous, mealy tub
that we were accustomed to in years far by-gone. Why is it
We must conclude that either the potato, in its varieties, is
nature short-lived; or that our unnatural treatment has indu
constitutional debility. On this point Mr Cuthill, in his pref
says,—"I would strongly impress upon those cultivating the po
the importance of attending to the shoots from the tuber, whic
forced, (whether by careless exposure to heat and moisture,
otherwise,) are weaker than if slowly developed, and will req
corresponding care in their after culture. All superabund

shoots which may have been allowed to develope under the above circumstances, are so many drains on the tuber, and a waste of that matter which has been laid up for the support of the plant in the earlier stages of its existence." Upon this principle, the practice now to be described has been founded, and the rules to be noted are:—

a. It must be clearly understood that all potatoes that are intended for seed ought to be well "greened," by being left on the ground until they are all but black, and not until then put by for next year. Mr Cuthill never saves his own seed store, because, his ground being limited in extent, he has little variety of seed; but farmers might easily exchange seed with one another, and so might cottagers, so as to save seed grown upon a strong earth to be planted next year upon a lighter—and *vice versa.* He says, "I order my ash-leaved potatoes as soon as they arrive in London, sometimes in October, or early in November, before the eye has grown at all."

b. On the season of planting, Mr Cuthill says, "April is much too late: even autumn planting is better than that, because the constitution of the potato does not suffer the injury which results from putting away the tubers in large heaps to waste themselves in growth, to be thrown away in spring. I have seen this spring (1847) several tons of potatoes brought to market with shoots at least five inches long: what would these have been after a mild winter?"

c. The "old and barbarous plan of cutting the potato" is earnestly deprecated, and with great justice, with the ash-leaved kidney. Indeed, Mr Knight of Downton would never sanction cutting even the latest varieties, however large the tuber. It is added, "I have found a tuber the size of a bantam's egg produce, on my plan of saving the first shoots, as early and good a crop as a set four times the size." I may add to this, upon the authority of experiment performed this year—in which I have not had a single defective leaf or root among the ash-leaved—that tubers not larger than a scarlet-runner seed, set by the dibble, have produced three, four, or five potatoes larger than those planted, and in many instances large enough for table use.

With these practical rules in mind, we may now come to the processess of culture. These shall be given as they occur in Mr Cuthill's pamphlet, taking into the account that the avowed object is to produce the *earliest*, and consequently the most profitable, money return. With the private grower for home consumption, some latitude must be allowed; therefore I shall add such remarks as may appear likely to be of practical utility to the cottager and the domestic gardener:—

The moment I receive the potatoes, I place them under the stage of a cold

green-house, their heads all laid one way, in close succession, taking care that no water fall upon them. Nothing more is done till about the middle of January, by which time they have perhaps grown about an inch. The shoot is very strong and green, the young fibres striking out from the base of the shoot very bold and strong. I now put as much mould upon them as will just cover the potatoes, and give them one watering to mix the mould well between them.

They are then left untouched until planting-out time—they are not even watered—because the less water given to them the harder and more wiry they become, sending out an immense quantity of roots to collect food: in fact, when taken up by the middle or end of February, they have produced a complete mass of strong fine roots.

The ground is meanwhile prepared; but before we describe the method, some allusion must be made to another authority, as I find it in a recently-published number of the *Horticultural Society's Journal*:—

Mr Errington, gardener to Sir Philip Malpas de Grey Egerton, is a a very able authority, and his paper on the "Potatoes for 1849" merits consideration. The ash-leaved kidney, he observes, is still undoubtedly one of the best potatoes in the kingdom—indeed the best of all for very early purposes, provided the seed is carefully preserved, and fermentation avoided. It can by no means endure fermentation, which it is almost sure to encounter in pits. Does not this, then, offer a hint that fermentation may have been one fruitful cause of the present disease? (I have constantly asserted this fact, and dwelt on it as most important.) This kidney, on account of its precocious character, must not be kept in a very damp situation for seed purposes, it being liable to sprout with the least excitement; and if the first sprouting is destroyed it is no longer worth planting: it is almost sure to breed abortion at the root, without producing sound stems. The keeping properties are very considerable—it remains fit for use until March, if properly managed. Whatever kinds are used, three points are absolutely necessary, viz.—*early planting*, not later than the middle of March; *early taking up*—that is to say, the moment the diseased blotch appears on the leaf, for immaturity is better than disease; and lastly, an avoidance of fermentation. I would build all the pits or stores above the ground-level, or rather on an elevation. In the second place, I would strew the ordinary soil all through them, and also form a core entirely of soil down the centre of the pit. The soil among the potatoes not only prevents fermentation, but, by preventing, arrests the spread of accidental decay in any of the tubers. One great point will be gained to the country by this early course—*potatoes will be entirely off the land by the middle of July:* thus a crop of turnips may follow, or the best opportunity will be afforded for the preparation for corn of any kind, and for cleaning purposes. The *old ash-leaved kidney remains as sound as ever*, at least with me, and produces enormous crops; but this kind has never suffered a fiftieth part of the abuse which other kinds in general, especially the later sorts, have undergone. Here, then, rests a *strong fact!*

So far, with a few abbreviations, I have chosen to trespass upon Mr Errington's article; and with great satisfaction, as I entirely agree with him on the leading points—especially as they tend to fortify every one of Mr Cuthill's positions. Cool situation during winter, particularly in some dry cave, or potato-house, deeply thatched with straw, wherein no frost can enter, and no water accumulate—these are the precautions frequently urged by me for years past; and I may now add that, in cases where Mr Errington's pits are adopted, charred turf or sawdust, carbonised peat, or any substance blackened by fire, would be an improvement, insomuch as it would retard growth, correct putridity, and be itself free from any particle of decomposable humus.

Preparation of the ground is effected by Mr Cuthill during winter, when very little dung is used. It is trenched two spades deep, which we may estimate at 16 inches, considering the slope of the instrument, and laid up in ridges 20 inches from centre to centre. As soon as the ground is trenched, he sows about two hundredweight of common salt, and three or four bushels of soot over the ridges, these being the proportions for 13 rods, (each 30¼ square yards, = 5½ × 5½.) This quantity of salt, which amounts to rather more than 21¼ hundredweight per statute acre, will startle many. Mr Cuthill assured me that he had mixed one ounce of salt with the earth of a 24 size pot, and planted therein a *growing* potato—the existing shoots perished, but the tuber had developed others which did well, and the plant finally yielded several small potatoes.

"*The planting* is commenced about the middle of February, by taking up some sets very carefully, and placing them in the *bottom* of the first *space* between the two out ridges. The whole of the mould of the second ridge is then laid over them—being of course careful not to wound the shoot, which is by this time, three, four, or even five inches long: but sets prepared in the above manner are so strong, that it is wonderful what rough usage they will endure." Thus all the hollows are planted, and all the earth of adjoining ridges, whether it be on the right or left,—according to the order of the work turned over them, and laid up as right-angular ridges, covering the potatoes at least six inches deep.

The thorough *greening* of the tubers is indispensable, and time is gained, as in the Lancashire method, by sprouting the seeds in some warm apartment, till the shoots are plainly developed; but, otherwise, the growth will be equally secure by planting in the hollows, without any previous process. I put my small stock—some not larger than common beans—into the cold ground last January and February, and lost none, or scarcely any, excepting where some intervening rows of broad-beans of rapid growth completely smothered them.

Mr Cuthill tells us that "sometimes the sprouted shoots have been eight inches long, and then he has laid them horizontally in the bottom: such plants have brought large crops, on account of the great length of stem below ground. He never attempts to mould them—indeed, it would be impossible, as there is no mould to draw to them." I saw the plants in May, during the continuance of that remarkably hot and parching weather which succeeded to the drenching rains of April. They were growing through the ridges, but not so regularly as we could have wished—many taking a slanting direction through the sides, instead of passing up to the centre angle of the ridge, so that the order of the plot was interrupted. This, however, proved of no consequence. A thought has suggested itself which might be acted on, and lead to some

melioration of the prevailing disease. If length of shoot laid under ground horizontally produces *large crops* then, what might be the result of allowing more space between the rows, and *layering* the long shoots three-fourths of their length,—so far, indeed, as to meet the shoots from the adjoining rows? Would not the covering soil protect the buried stems, cause the development of new tuber-bearing processes, and, at the same time, expose foliage at the summits sufficient to admit of the agency of light? Any reasonable experiment is admissible under circumstances so perplexing. Mr Cuthill says—

> When the potatoes come up, they grow so fast that they soon smother the weeds. If the month of May prove dry, as it is in some seasons, I am obliged to water; and when I do, of course I continue it twice a-week, until rain comes—as, if watering be not continued, you have only brought up the fibres to be killed by the heat of the sun. In some instances I have endeavoured to avoid the necessity of watering, by laying long litter between them to keep them moist; but, as it seemed to me that this kept them later, I have discontinued it.

When I saw his plants in May, water had not been given. There had then been about three weeks of the most parching weather, and I mentioned the circumstance; but the foreman remarked, that so profuse had been the rain in April, the ground could not be dry.

I am not quite satisfied with the statement, because the vegetation had every appearance of wanting moisture; and few are aware how intense and rapid is the evaporation of water under the influence of a sun so powerful, which, during nearly 21 days, had poured its beams upon an exposed surface for about 15 hours of each day. April had been profusely wet, but by the 1st of May scarcely a vestige of superficial moisture could be discerned; and in a very short time the ground cracked, the growth of hay-grass was arrested, and its bottom never so recovered as to be of any utility in the early-mown fields. Watering, at the best, is an ambiguous remedy: in the field, it could not be adopted, and, therefore, can only be applied to small garden plots. Even there, if potatoes be set on the ridge-and-furrow system, it would be advisable, after three day[illegible] settled weather, to fill the latter with half-decayed leaves, [illegible] furze litter, decayed thatch, and the like; and I [illegible] result would, in every respect, be very satisfactory. [illegible] retardation of a few days, it could be of no moment [illegible] domestic [illegible] ust, though, to the grower for early sale [illegible] handsome [illegible] it might be disadvantageous.

The ash-[illegible]ved kidney is generally reckoned a small bearer—market-gardeners, I now find, are not fond of planting largely. Mr Errington, as we have seen, produces heavy crops: Mr Cuthill thus alludes to the productiveness of this fine variety, as influenced by his mode of exciting and planting:—"The quantity of potatoes for such a shy bearer is very great, depending, I imagine, upon the length of stem below ground, and the great strength both of

this and of the roots—the best guarantee of a fine crop. In order to prove the superiority of the plan, I planted one row across the same border, as usual, on November 6th, 1845. This row produced 1½ lb., while those managed as above described yielded above 4½ lbs. The November potatoes were small, and in full growth at least fourteen days behind the others." My own experience with a large plot, planted in entirely new ground, late in the autumn of 1846, rendered me very suspicious of this attempt. The season proved rainy, it is true, and a very protracted frost followed. I lost every potato by decay of the sets. It is also right to observe that autumnal-sown potatoes are always more tardy, as indeed are those tubers which remain undisturbed in the soil.

Little remains, to do Mr Cuthill's system full justice, but to extract from one of his pages the following statement of the actual product of his crops from about a few bushels of seed potatoes, planted in 15 or 16 rods of ground, by the furrow-and-ridge system, already detailed. The estimate is made by the amount of money received.

In the year 1843, we read—"Began taking up at 1s. 6d. per lb.—received about £19.

In 1844—"Began taking up, May 14, at 1s. 6d. per lb.—received about £20—a little more ground this year." The month of April was extremely warm and dry.

In 1845—a cold wet season—"Began taking up, June 12, at 1s. per pound—Money received about £15—rather less ground—about 15 rods."

In 1846—April, and the first half of May, showery: the latter half hot and parching—"Began taking up May 20th, and selling them here to green-grocers at 1s. 3d. per lb. at Covent-garden Market: a contract to supply 500 lbs. at 6d. per lb. large and small—to send them up three times a-week. The quantity of ground was the same as in 1845—15 rods; and the total produce, sold to various persons, fetched upwards of £18.

In estimating the quantity of potatoes yielded from the 15 rods usually planted, I refer to a private letter just come to hand, wherein Mr Cuthill tells me, he plants 190 entire tubers in each rod at the distance before mentioned; the size of the tuber being such that 500 of them will, as nearly as possible, fill one bushel imperial measure—that is, about 3 inches in length: consequently the number in 15 rods amounts to $190 \times 15 = 2850$—equivalent to 30,400 per imperial acre. If the cost of about 5½ bushels of seed potatoes, planted in 15 rods of land, may be averaged, one year with another, at 10s. per bushel = £2, 15s., the profit, after deducting all contingent expenses, must be found very handsome. But another circumstance, of serious import, must be adduced in favour of *early* planting upon the ridge-and-furrow system. A second crop may, in five seasons, be obtained, as I collect from the following passage in the letter I just named:—

I have now (Oct. 26) an excellent second crop from potatoes ripened off in July, planted again in August, and now one foot high, showing clearly that two crops could easily be obtained in one year from the same ground. Had I thought upon it sooner, I could have planted at least a month earlier, which would have insured a good crop.

Mr Knight of Downton communicated to me, some years before his decease, a process by which he readily obtained a second crop of early potatoes; and when I inspected Mr Cuthill's garden in the last summer, I am certain that the tubers, then remaining in the ground, were so perfectly mature, that after a few days' exposure to green them, they would have speedily vegetated. Other facts—some of which have been before named, seem to prove that this secondary vegetation is, in every instance, healthy and free from taint. A large market gardener told me, a month since, that, although he had seen a good deal of disease among his summer ash-leaved, he then had hundreds about his grounds that had germinated from undug tubers, without the least appearance of spot or disease.

We may hence infer that the earliest, and *very* late plots—so late as to have been sown in July, or during the first half of August—afford encouraging prospects; and should the bogs of Ireland be reclaimed, by removals and carbonisation of the inert peat, the agriculture of the sister kingdom might be enlarged and improved to an extent the consequences of which cannot be appreciated.

The Artificial Fattening of Stock. By MATTHEW M. MILBURN, Land-Agent, Sowerby, Thirsk.—The ordinary process of growing corn, year after year, is one exceedingly prejudicial to the soil. It is hardly possible to conceive how robbing the land of its products should not end in its barrenness, when cultivation shall become no longer profitable. On ill-managed clay soils especially, where corn crops, with the intervention of only now and then a fallow, are year by year removed and sold at a distant market, and where the only animals allowed to live on the soil are a few calves, and the number of draught-horses required to cultivate the land—it is quite clear the soil must be continually further and further exhausted. Again, on light soils, where consolidation is a very important object, and where sheep-farming is mainly pursued, great difficulty is experienced to get the straw converted into good manure. It is easy to allow the straw to accumulate until it is rotted by the mere action of the rains which descend upon it, or it is equally ready to allow a number of store or starving cattle to tread it into manure. But such manure is little better than rotten straw; and if many turnips are removed, wherewith to fatten the animals, from such soils, the want of treading, and soiling, and consolidation, are visible in the subsequent crop of barley, in the lea which follows, and in the wheat which succeeds—so that, both on light and on very heavy land, no cattle can be fatted in the house but at the expense of the subsequent corn crops, and yet to obtain manure for after green crops, it is absolutely necessary to feed cattle, and convert the straw into something better than broken down woody fibre.

The fat of animals is strictly analogous to vegetable oil—its ele-

s are much of the same character as sugar, starch, and , and no doubt is entertained, by physiologists and chemists, the fatty matter (vegetable oil) in plants is assimilated into al fat with but little change, while a decomposition and re-ination are necessary in converting the elements of sugar, h, and gum into the same proportions in which they exist in table oil, or in animal fat. The elements of these compounds rally are:

	Sugar.	Starch.	Gum.	Mucilage.	Animal fat, (stearine.)
Carbon,	12	12	12	24	71
Hydrogen,	11	10	10	19	69
Oxygen,	11	10	10	19	7

ie oil contained in many seeds is given by Professor Johnston:—

	Oil per cent.		Oil per cent.
seed,	11 to 22 say 17	White mustard,	36 to 38 say 37
np seed,	14 .. 25 ... 19	Sweet almond,	40 .. 54 ... 47
e seed,	40 .. 70 ... 55	Bitter do.	28 .. 46 ... 37

iis would naturally indicate that any of these seeds would, so s they were palatable, be useful; and when linseed contains as 1 as 7 per cent of mucilage, 10 per cent of sugar, and 15 of le albumen, it is clearly indicated as being a seed most valu- for feeding and nourishing purposes.

arious attempts have been made to adapt it to the feeding of e. There was difficulty in its being ground by ordinary mills, ; clogged up the teeth; and when given to animals either ;, or even combined with considerable quantities of corn or , or other feeding matter, the effect on the animals was pur-'e, and but few persevere in the use of the seed alone. The ind for the oil induced the crushing of the seeds to obtain it, the refuse left was found to be very valuable as feeding mate- and the portability of oil-cake, its cleanliness, and capability eing long kept, made it a general and desirable food, both for ing and feeding stock. The oil abstracted, the cake contains, rding to the same accurate authority, of

Water,	10·05
Mucilage,	39·10
Albumen and gluten,	22·14
Oil,	11·93
Husk,	9·53
Saline matter, and sand,	7·25

'e do not see exactly how the cake can contain so large a pro- on of oil relatively with the seed; but it is probable that the had originally contained a large proportion of oil, and that it been but indifferently crushed. Good English-made cake,

however, has been thoroughly established as one of the best of fattening products; and the extensive farmers of Lincolnshire and other places expend as much as £400 to £500 upon a single farm in one year for this artificial food; and so well understood is its fertilising character, that many landowners are willing to make themselves, and their incoming tenants, chargeable with proportions of the money so expended, at the rate of one-half to one-third. It is the opinion of some of the best farmers, that when cake can be purchased at the same per ton in pounds, that beef and mutton can be sold for per stone in shillings, it will be paid for in the cattle and animals fed, without reference to the manure. The price of cake, however, depends on no such element of calculation—the demand for it has increased far beyond that of the oil; and in some seasons it became so great, that the former was an object of commerce rather than the latter, and realised as much as twelve guineas per ton.

Attempts have been occasionally made to render the seed uncrushed assimilable by a cooking process, but it was generally more adapted for calves than for store stock, or for fattening; and if at all in the latter case, it was only to supply a deficiency in turnips which took place in the years 1825, 1826, and 1827, in consequence of the excessive drought throughout England, and when linseed in various shapes was used as a substitute.

The most decisive step, however, in the use of cooked linseed, was made by Mr Warnes of Trimmingham, near North Walsham in Norfolk, in 1841, when a discussion was appointed by the farmers' club there, on feeding cattle with linseed cake. Mr Warnes commenced by inquiring into the nature of cake, and found it consisted of the refuse of linseed. He immediately commenced a series of experiments with linseed in various forms—crushed, steeped, boiled, cooked in various ways. He also tried the boiling of barley and other food on various animals. He ultimately adopted a mode of feeding, on what was called by him linseed compound, and carried out further his experiments to the growing, dressing, and preparing of flax,—the feeding of cattle with the prepared seed in boxes as antagonist to tying up, and the summer grazing of cattle by soiling.

In order to witness the whole of these processes, which were exciting so much attention, not only in England but in Scotland and Ireland, we paid a visit to Trimmingham, and was received by Mr Warnes with a friendliness and hospitality which bespoke a philanthropic and well-regulated mind; and he laid open the whole of his plans with a degree of candour and openness, which showed that his object was to benefit others, and not keep his discoveries exclusively to himself.

His cooking apparatus is so simple that it is managed by a blind man, and whose stout and happy countenance bespeaks neither

overweening anxiety, nor unremunerated toil. The apparatus consists of two cast-metal boilers, fixed in brick, and having under a fireplace, and the water is made to boil before the linseed is put in. The seed is crushed by a very powerful implement, made by Messrs Harwood of Ipswich, and consists of two cylinders, one of large diameter, which are made to press upon each other in their revolutions by two lunar springs, and will grind thoroughly 2 bushels in 60 minutes by two men, who, at this rate, are able to work the whole day. It is capable, however, of being reduced to the capacity of one man. The crushed linseed is sprinkled upon the boiling water at the rate of 1 gallon of seed to 8 gallons of water: great stress is laid on *sprinkling* the linseed very gradually, otherwise it is apt to adhere in lumps, and cleave to the sides or bottom of the boiler. With this precaution, however, Mr Warnes assures me he has never had an instance, for several years, of this alleged disadvantageous state of things. This boiled six minutes, and for that period was slightly stirred, and at the end of that time was found to be a thick gelatinous mass. We must, however, admit, that in one minute after this, the mass became more mucilaginous, and we think was improved. Nine bushels of cut pea-straw were then placed in a tub 28 inches high, very gradually by one bushel at a time, and the liquid jelly was taken out in a scoop, and poured upon it, and at each addition the whole was rammed down by a kind of beater, more for the purpose of mixing the mass, and confining the heat, than for any other object. The present cost of the animals in linseed is 3s. per head per week. They have also about 1 bushel of cut swedes per day. The animals to which Mr Warnes at present gives the compound, are 7 cattle, 9 horses, and 40 sheep.

Mr Warnes occasionally mixes his compound with corn, or rather with meal. This, when used, is also sprinkled in the boiling mucilage; but when we saw the process, it was not used. So soon as the first boiling was nearly emptied from the boiler, it was again filled with water, and was ready for another boil, either at that time, if necessary, or on the next preparation.

We examined the stock carefully, and we cannot compliment Mr Warnes on the happiness of his selection. The sheep were French, and, we should say, next to impossible to fatten. The cattle were also hard feeders, but were evidently progressing rapidly.

As a test of its value, he furnished the writer with the following remarks and experiments illustrative of the effects of his system:—

Linseed has five essential properties—viz., mucilage, oil, albumen, gluten, and sugar. The shell, or external crust, is the hardest of all seeds, and the most difficult to break in pieces; but not too much so for the miller, who, aware that if coarsely crushed, much of the oil could not be expressed, has every particle ground almost to powder. This is demonstrated by the cake, in which the presence of linseed is scarcely apparent. To a similar state, I contend, linseed for the cattle

compounds ought to be reduced; otherwise some, at least, of the properties above described will pass off without benefiting the fattening animals. This the scientific grazier will discover by the excrements, and find sufficient cause, not only for grinding linseed, but also grain or pulse, if possible, into flour. From philosophical researches like these the profitable returns, for grazing upon my premises, may be dated,—returns, such as are portrayed by the following figures:—

7 Durham bullocks cost, .	£59	10	0	Sold within 6 months for,	£136	10	0
10 Scotch ditto, . .	100	0	0	Ditto ditto, . .	215	0	0
1 Cow, ...	5	5	0	Ditto ditto, . .	15	0	0
10 Miscellaneous small cattle,	40	5	0	Sold within 9 months, .	136	0	0
	£205	0	0		£502	10	0
					205	0	0
					£297	10	0
Deduct for 14 qrs. of linseed, mostly grown upon the farm, £35; and £4 for barley-meal, ...					£39	0	0
Return for 19 acres of turnips, several acres of pea-straw, and about 3 months' autumnal grass for the 10 miscellaneous cattle, . .					£258	10	0

The linseed, with the pea-straw and turnip-tops, was formed into compound; the turnips given raw, and the barley-meal as circumstances required. Under the old system, the turnip-tops would have been mainly destroyed, and the pea-straw used for litter. But these having been employed as above described, will account for the small consumption of turnips, and show the immense importance of such auxiliaries.

The expenses of his copper and whole cooking apparatus, for 80 or 100 head of stock, will not, he states, be more than £4.

A part of Mr Warnes' system is the feeding in boxes, the growth of linseed, the manufacture of the fibre into flax, and the soiling of cattle with green food and compound in the summer. It would swell this article much beyond the legitimate limits if the box system were at all fully described. It may suffice to say, that the boxes of Mr Warnes have been put up very cheaply—they form two sides of what has formerly been a fold-yard. The sides have had a roof put along the wall side, supported by pillars of wood, and divided by rails of any ordinary wood, the front next the yard being enclosed by two gates. The box is 8 feet 6 inches square; and adjoining the wall is a passage from which the food is given in troughs, which are made to slide up or down as the manure accumulates. The manure is never carted out until it is taken to the fields; and as the boxes are walled for one foot from the bottom, there is not the slightest escape of the liquid manure. Of course it is peculiarly rich, both from this circumstance, and from the stimulating food supplied to the fattening animals. We observed in various parts of Norfolk a variety of kinds of boxes, much after Mr Warnes' model, some much more costly, and which their owners think doubtless great improvements, but which we much doubt: and as Mr Warnes' may be erected at small expense, say £1, 10s. to £2 each, and may be removed legally by a yearly tenant, they are such as tenants may easily erect.

Much has been said as to the dirt and filth, and unnatural state of the animals; but their condition is precisely the opposite in every respect: they are quiet, have exercise sufficient for healthy secretion, can feed at leisure, and, wherever we observed, they were clean and free from smell, and every thing objectionable. The fact of the treading and thorough consolidation of the animals' feet prevents fermentation, and the consequent evolution of gases, which would take place if mere stall-feeding were practised. On the whole, the writer thinks, there are many more, and more valid reasons for, than against, box-feeding.

The direction given to men's minds by the experiments of Mr Warnes induced trials with all kinds of modifications of linseed cooking; but the one which has obtained the greatest amount of favour, is that adopted by Mr Marshall of Holme Lodge, near Thirsk. The great difference between this, and that of Mr Warnes', is, that the material cooked has not the heat applied to it directly, but applied to the outside of the boiler in which it is to be cooked, so that no direct application of the fire shall take place, to burn the mucilaginous matter. Mr Marshall insists that, to cook the material properly, it must be boiled at least two hours.

His mode is this,—one pound of linseed is boiled for two or three hours in about one and a half gallons of water. Five pounds of straw are chopped, say one inch long, and mixed with two and a half pounds of ground oat or barley meal very intimately, and is then placed on a floor of flags or bricks, and the boiled linseed poured upon the mass, and turned, and then allowed to remain one or two hours, when it is given to the cattle. The proportions given below are for one animal, though, of course, the food for many is cooked at the same time: The cost is, at linseed at 6s. per bushel, for each animal per week:—

	s.	d.
12 lbs. 6 oz. of linseed per week,	1	4½
32 lbs. of corn, at 11½ per stone,	2	2¼
Labour divided per head,	0	6¼
Coals,	0	0¼
Interest of cost of apparatus,	0	1½
	4	4¾

Mr Hutton, of Sowber Hill, who has carried out the scheme very fully, gave the following experiment with the linseed compound, as compared with oil-cake. In this the turnips were charged as well as the compound, to make the terms equal.

Sixteen polled beasts (cows) were taken up. They were divided into two lots; each lot, consisting of eight beasts, was as nearly equal in weight and condition to the other as possible.

One lot was fed as follows, costing 6s. 10d. per head:—

	s.	d.
Linseed cake, 3 stones, at 13½d per stone, .	3	4½
Turnips, 960 lbs., ...	3	0
Labour, ...	0	5½
Per week for each head, .	6	10

The other lot was fed upon prepared food:—

	s.	d.
Linseed and ground corn, ...	4	4
Turnips, 490 lbs., ...	1	6
Labour, &c., ...	0	5½
Coals, ...	0	6
Per week for each head, .	6	9½

The two lots were sold at Bedale market, on two different days; four being taken from one set of beasts, and four from the other set, at each sale. The cattle fed upon prepared food realised £2, 6s. 6d. more than those otherwise fed. The time occupied in feeding them was eight weeks.

The cost of the apparatus and fitting will be about £50. On the whole, we think one or the other process is very desirable to be adopted in all situations where an increased quantity, and better quality, of manure is a desideratum.

Mr Warnes, unprejudiced in favour of his peculiar system, was, when we were there, experimenting on the mode recommended by some, of steeping the linseed-meal in cold water for some 12 or 14 hours, and a slight mucilaginous deposit was the result. By him the experiment will no doubt be carefully and accurately made, but we confess our prepossessions are in favour of the cooked materials.

Experiment on the Thin Sowing of Wheat. By Mr GEORGE W. HAY, Whiterigg, Roxburghshire.—3*d November* 1847—Sowed one and a half ridge of land with wheat after Swedish turnips, to make trial of Michi's plan of thin seeding, in comparison with our usual mode of thick seeding.

Th[illegible] land sown was equal to the one-fourteenth of an acre, and th[illegible] [illegible] ised was the one-tenth of a bushel of pearl wheat, equal [illegible] one four-tenth bushel per acre; the other part of this field was [illegible] with three bushels per acre.

[illegible]ng the winter, the thin-seeded looked thin on the ground, [illegible] [illegible]ways a healthy, green appearance; the thick sown, however, [illegible] [illegible]nised to be the best crop. Both portions of land were [illegible] broadcast; the thin-seeded had not a good chance from the [illegible]ateness of the season when it was sown, not having time to shoot [illegible] before winter.

[illegible]*uly* 1848.—Examined the two kinds of wheat after they were [illegible]lly shot out, and am of opinion that the thin-seeded is the best [illegible] every respect, taller in the stalk, longer in the head, and, though [illegible]ot [illegible] thick on the ground, will prove, I believe, the best crop in [illegible] [illegible] [illegible]ualit[illegible]

14th September.—Both portions of land were reaped.

19th September.—Weighed the produce, straw and grain, from a ridge of each kind,—

		cwt.	stones.			stones.
Thin-seeded, straw and grain, weighed, . .		2¾ =	22 =	per acre,		462
Thick-seeded, ...		2½ =	20 =	...		420
In favour of thin-seeding, . . .		¼ =	2 =	...		42
		bush.	pks.			
Thin-seeded, thrashed, gave, of good corn,		1	½			
... ..., light corn,		0	1½			
				bolls.	bush.	pks.
		1	2 =	per acre, 4	1	2
	lbs.					
Weight per bushel, . . .	58					
		bush.	pks.			
Thick-seeded, thrashed, gave, of good corn,		1	2			
... ... light corn,		0	1			
		1	3 =	per acre, 4	3	3
	lbs.					
Weight per bushel, . . .	59					
In favour of thick-seeding of corn, .		0	1 =	... 0	2	1
	lbs.					
... ... weight per bushel,	1					

The boll contains 6 bushels.

It will be seen, by this experiment, that the whole produce of straw and grain is greater by weight on the thin-seeded portion than on the thick, while the wheat is not only of greater quantity, but better quality upon the thick than upon the thin; at the same time, the seed saved per acre must be taken into account.

The price of wheat-seed, when required for fallow, is never less than from 8s. to 10s. per bushel—the thin saving fully a bushel and a half per acre, would give an entire saving of from 12s. to 15s. per acre, which is considerable; and it would be of great consequence, on the sowing of a large break of fallow wheat—that being the time to sow thin—as the plant would then shoot out before winter, which would not be the case (such as mine) after turnips; and I am convinced, had the wheat been sown either on fallow, or even in spring, it would have been much better, the season having been unfavourable for it.

From the general appearance of the crop, I was induced to sow a small 3-acre field this autumn with wheat, at the rate of 1 bushel to the acre, which is at present very promising, being as thick on the ground as I could wish for under any circumstances.

This small field was broke up from second year's grass which was very bad, the soil being wet, with a cold bottom, drained during the summer, every 24 feet with egg-shaped pipes alone, without

stones, to test their efficiency—2½ feet deep, broken up with 3 horses across the ridges, worked and well cleaned and pulverised with Crosskill's roller, manured with ordinary quantities of farm-yard manure, and seed-harrowed on 28th August with about 4 cwts. of prepared manure per acre.

In this trial I expect a different result from the other, for it possesses advantages which the other had not; and to test the thick and thin seeding fairly, I have a double ridge in the middle of the field, sown at about 3 bushels per acre, so that at reaping-time it will be seen which has the advantage; at present, (24th November,) the braird on the double ridge appears much too thick.

Autumnal manuring.—It is sometimes objected to the plan of applying the manure for the turnip crop on the oat-stubble in the autumn, that the volatile part (as the ammonia) will be dissipated, and that the soluble part will be washed away by the winter rain. I have every reason to believe that this impression is erroneous, or that at least the waste is not more than takes place in the best-managed manure-heap, and must be much less than the loss which now takes place in ninety-nine out of every hundred farm-yards in the country. The investigation of Kuhlmann shows that no fermentation takes place at 32° F. in manures, and that it requires about a moderate summer heat to carry on the process with vigour. There is, I believe, little or no ammonia in the dung or urine of animals when it leaves their bodies—the ammonia is generated by fermentation; so that, if we can keep the dung or urine at 32° F., the fermentation and consequent production and waste of ammonia is avoided. Every one knows that for many weeks in winter the temperature of the soil does not greatly exceed 32°, or that of freezing water.

When large quantities of manure are heaped together, a great heat is speedily evolved by the fermentation, and the ammonia, in consequence of the rise of temperature, is entirely drained off. On the other hand, when the manure is spread over the land and ploughed in in the autumn, it is in too small quantities together even to raise the temperature to an injurious height by its own fermentation. Besides, the ground, by the frost and snow of winter, is seldom much above the temperature of 32°, which effectually stops the decomposition of the manure, and the production of ammonia. Should this gas be produced in small quantities, it will be absorbed by the clay and charcoal present in the soil.

Nor will there be such a waste of the inorganic or mineral part of the manure as might be expected. This is protected from the action of the winter rains by the vegetable matter with which it is in combination. If any one, by a very simple experiment, digests *fresh* straw in water, he will soon satisfy himself how completely insoluble it is; but if straw be allowed to rot, or what is nearly

the same, if it be burnt, all its constituents which are soluble in water, can be easily dissolved.

This practice of applying the farm-yard dung in a fresh state before the autumn ploughing, is becoming very general on the strong lands of the best part of Scotland, when it is found very useful, not only by producing good crops of turnips, but also by saving time in the spring, or more busy part of the year.

M. B.

Fresenius on manures.—In no part of Fresenius' work do we see so good an example of his style, as in the portion under this head.—He observes that—

The business of an agriculturist consists in producing a greatly increased vigour of growth, as compared with that produced, when the plants he cultivates are in a state of nature. Besides this, he at one time grows a plant for its seed, as the grain crops,—at another for its leaf and stem, as clover or tares,—at another for its fibre, as hemp or flax—and at another for its root, as potatoes and turnips.

It must be obvious that there is but little soil in which these different purposes can be obtained by a farmer, year after year, by the unaided efforts of nature. The soil must be maintained, in a certain degree of richness, with regard to the mineral (and perhaps the vegetable) part of vegetation; and if it has not this necessary condition, the farmer must endeavour to supply it,—or, in other words, he must add *manures*.

Before we can estimate the value of a manure to a certain soil, we must be able to answer the four following questions:—

1*st*, What nourishment or food does the plant we intend to cultivate draw from the soil?

2*d*, What mechanical state of the soil is best suited to each plant?

3*d*, Does the soil contain the necessary constituents of the plant?

4*th*, And what does the manure contain or consist of?

1*st*, *What nourishment or food does the plant we intend to cultivate draw from the soil?* We have here four points to decide:—

a. What are the ashes of the plant composed of?

b. How much of this ash does the plant require?

c. Can the plant draw the nitrogen it requires from the atmosphere?

d. And can the plant draw the carbon it requires from the atmosphere?

The first and second of these questions have been answered by chemistry; and though the application of the information thus obtained, may not seem very clear to the practical man, there can be no doubt but that the advance of education and science must speedily place it within the reach of every one interested in the matter.

The other two come more especially within the province of the farmer himself to answer, as they obviously cannot be answered by chemical analysis, but by comparing the growth of plants under varied circumstances.

From these questions, however, the following one arises, and is of especial importance to the farmer: Is a certain supply of inorganic matter in the soil alone sufficient, or must we add to it a certain quantity of decaying vegetable matter, and animal matter or ammoniacal salts? And, even supposing the application of the vegetable and animal matter should be found profitable, it is interesting to ask the question, how do they benefit the plant? Does the decaying vegetable matter not act a double part? In addition to supplying carbon, does it not act chemically by decomposing and rendering soluble the insoluble silicates and phosphates?

Suppose this matter clearly understood, I would then know that the plant A requires a certain salt, in a certain quantity, and in a certain state of chemical combination. I know that it can, without prejudice to the crop, draw all the carbon and azote necessary for its growth from the atmosphere; I may also expect a good harvest if even the soil contains no carbon and azote, provided the necessary salts are so supplied as to be soluble in water, or at least in water containing carbonic

acid. Further I would also know that a certain other plant B, can grow in a soil where the salts necessary to its growth are supplied in the soil, but that the crop will be increased if the carbon and azote are supplied to it by the soil also, and not, as in the previous case, by the atmosphere.

2d, What mechanical state of the soil is best suited to each plant? This is a question which every farmer learns from experience to answer for himself. For instance, he knows very well the soil which is in a fine enough state to grow wheat, would not grow a single turnip, and so on.

3d, Does the soil contain the necessary constituents of the plant?

This question can only be exactly known by chemical analysis, and great steps have already been made by the chemists of the present day; but it is evident that it is impossible for every farmer to have his soil analysed, nor indeed is it absolutely necessary; for as soon as he has learnt to pay proper attention to geology, he must be aware that his soils are formed from the remains of the rock on which they lie. Now, as the chemical constitution of the principal geological formations, as chalk, clay, slate, granite, &c., are accurately known, the well-educated farmer will obtain for himself a tolerably accurate analysis of his soil, by consulting any of the numerous works containing analyses of these rocks. It is therefore to the careful and laborious examination of these rocks that I would direct the attention of all scientific men.

4th, What does the manure contain or consist of?

All substances which have hitherto been used as manures, may be divided into two classes—

1. *Inorganic manures, or those of inorganic origin.* These are either (A) *a simple chemical compound*, as gypsum, common salt, or phosphate of lime; or (B) *a mixture of various substances*, as marl, the ashes of plants, and many others. The composition of these latter is now well understood, and a tolerable approach has also been made to an estimate of their value.

2. *Organic manures, or those from living animals.* These latter are very numerous, as the dung and urine of men and animals, bone-earth, guano, leaves, &c.* The question naturally arises—to what is farm-yard manure and the above substances indebted for its value? The answer is—they contain the ashes or mineral part of the plant, &c., which have been the food of the cattle producing the manure. In farm-yard manure this can hardly surprise, if we consider its origin; it is but the food of the cattle altered, or, in other words, consumed by passing through their bodies. Chemical analysis has shown that these manures consist of—

1st, Salts soluble in water.

2d, Salts containing nitrogen, and nitrogenous substances, and—

3d, Decomposing carbonaceous matters.

It becomes of importance to the farmer to ascertain whether these substances can be so combined and prepared, by the aid of chemistry, as to be of the same value to him as farm-yard manure, or even as an auxiliary to it.

We are old enough to remember hearing old farmers laugh very hard at their neighbours for using bones, alleging that it was impossible for so small a quantity to be of any use to the crop; and yet we may venture to assert that no one, between Land's End and John o'Groat's House, will now be found who is ignorant of their value. Here there is one auxiliary to farm-yard manure; for bones cannot be a substitute, as they consist of only phosphoric acid and lime, whilst farm-yard manure consists of phosphoric, sulphuric, and muriatic acids, in combination with potash, soda, ammonia, lime, magnesia, &c.

The next substance introduced into English agriculture was guano, or the dung of sea-birds. This was an improvement over

* This classification is the first we have met in the book which is exceptional.

he bones, as guano contains many more of the constituent parts of the plant than the former.

The third attempt will, if properly carried out, be of infinitely more importance than any of the others; we allude to the so-called artificial manures which are now so freely advertised. The foundation of this great step is certainly due to Liebig, as we believe that he was the first to propose to dissolve bones in sulphuric acid. It is difficult to explain this action without showing it by experiment. We will, however, do our best. When sulphuric acid is mixed with bones, a certain proportion of the phosphoric acid, previously in combination with lime, is at once set at liberty. Before the sulphuric acid was applied, the phosphoric acid was insoluble; but, after its application, one-half of it is rendered soluble in water. This is an important step gained, as one of the requisite ingredients is thus rendered immediately available to vegetation.

Muriatic acid has precisely a similar effect as sulphuric acid, only the muriate of lime which is formed has an injurious, or at least an uncertain effect on vegetation, whilst the sulphate of lime which is formed, when sulphuric acid is added, is itself of recognised value as a manure.

Carbonic acid has also the same effect; and we here at once recognise an important part which this acid, and the substances producing it, must take in vegetation. It has already been remarked that bones are quite insoluble in water: no sooner, however, are they covered up in a soil containing vegetable matter, than a decomposition takes place, and carbonic acid is slowly and gradually eliminated, and the acid as slowly and gradually acts upon the phosphate of lime, and sets the phosphoric acid at liberty for vegetation.

So that we see the same process going on in the soil containing bones and carbonic acid, as takes place when sulphuric acid is added to bones; only, in the latter case, there is an immediate effect, whilst in the former it is slow and gradual; consequently a smaller quantity will be sufficient.

Many farmers now prepare the mixture of bones and sulphuric acid themselves. This is well enough when very large quantities are used, and where it may be worth while to erect a proper apparatus; but upon a small scale, such as ordinary farmers can use, the operation can never be so effectually nor so economically performed as it can be by manufacturers. But here a serious difficulty occurs to the mind of every farmer.—Will the manufacturer be honest? This is an important question, and one which deserves the greatest attention. Fortunately the answer is in the farmer's own hand, and cannot be better expressed than in the words of the Agricultural Gazette of August 19th: Farmers will ultimately find "*it their interest to refuse to deal with all cheap salesmen without character.*" This is true in every sense of the word; and manufacturers

of artificial manures will soon find the necessity and advantage of endeavouring to secure their character by making a geniune good article, rather than by making a large profit by selling useless rubbish for one or two years.

To proceed with the description of the process of making dissolved bones, or super-phosphate, as it is more properly called: After the acid has been added and well mixed up, the whole mass assumes a pasty state, and requires to be mixed with something to bring it into such a state of powder, as to be applied to the soil. The farmers who prepare their own have various plans for this purpose—some mix lime, others burnt earth, &c., &c. The first is an effectual evil, because it again reduces the mixture to precisely the insoluble state in which it was before the sulphuric acid was added. Nor are some manufacturers any wiser than the farmer, for we have seen one sample of (so-called) super-phosphate analysed, and it contained 80 per cent of gypsum, with 2 or 3 per cent of phosphate of lime. Of course, such an article as the above can be sold at profit for £7 per ton, for gypsum can be bought for 30s.

We have perhaps made our remarks on this part of the subject too lengthy, but hope the importance of the question will prove a sufficient excuse. To conclude,—we have endeavoured to show the principle upon which manure manufacturers ought to proceed, and would also remind farmers that, though super-phosphate of lime contains soluble phosphoric acid, this is not enough: if artificial manures are to be of permanent value, they must, like farm-yard manure, be able to supply our crops with potash, soda, ammonia, alumina, phosphoric acid, and a great many other substances which the common farm-yard manure always contains.

Fresenius, in an amusingly earnest manner, recommends the use of French weights and measures, for reporting agricultural experiments, instead of the interminable German ones, as *morgen*, *juchart*, *tagwech*, *joch*, *malter*, *scheffel*, *simsi*, *metze*, *lester*, *viernsel*, *wispel*, *kumpf*, &c., &c., which he very properly says, no one ever takes the trouble to calculate into other measurements.

As a supplement to our remarks respecting the various component parts we recommend for artificial manure, we close this lengthy article by an extract from a table, in which is shown the relative impoverishing power of different crops, or, in other words, the quantity of mineral matter, in pounds avoirdupois, each crop removes from the soil per acre:—

	THE AVERAGE QUANTITY OF INORGANIC MATTER REMOVED FROM ONE ACRE—IN POUNDS.									
	Potash.	Soda.	Lime.	Magnesia.	Phosphoric Acid.	Sulphuric Acid.	Silica.	Chloride.	Azotised Matter.	Carbonised Substances.*
Wheat.										
Straw, .	23·84	—	11·90	—	1·99	18 24	129·13	5·77	69·7	989·7
Grain, .	8·71	3·32	1·03	4·41	18·32	2·34	·22	—	316·8	768·5
Total, .	32·58	3·32	12·93	4·41	20·31	20·58	129·53	5·77	386·5	1758·2
Rye.										
Grain, .	6·14	1·88	1·06	2·72	11·84	1·58	0·42	—	197·1	871·2
Straw, .	15·25	—	8·03	2·13	3·38	6·12	57·21	0·73	46·0	1122·4
Total, .	21·39	1.88	9·09	4·85	15·22	7·70	57·63	0·73	243·1	1993·6
Barley.										
Grain, .	13·29	4·28	2·60	6·85	30·39	2·75	24·68	0·38	315·53	1341·1
Straw, .	55·64	2·10	19·04	8·91	8·08	31·02	116·21	23·51	81·40	2385·0
Total, .	68·93	6·38	21·64	15·76	38·47	33·77	140·89	23·89	396·93	3726·1
Oats.										
Grain, .	8·36	—	1·59	5·24	10·07	3·95	31·98	0·35	242·9	991·2
Straw, .	13·36	14·66	8·01	5·03	·2·13	16·42	59·58	2·74	54·7	683·7
Total, .	21·75	14·66	9·60	10·27	12·20	20·37	91·56	3·09	297·6	1674·9
Red Clover.	144·00	119·23	158·4	47·8	36·28	18·36	28·80	34·56	926·0	5637·
White Turnip										
Root, .	112·20	3·57	35·70	12·75	33·15	42·48	12·75	12·75	555·0	3540·
Top, .	21·14	1·50	18·27	5·32	1·13	10·29	4·40	2·33	—	—
Total, .	133·34	5.07	53·97	18·07	34·28	52·77	17·15	15·08	?	?
Potato.										
Tubers, .	100·44	—	6·51	17·11	27·90	13·78	11·16	10·78	524·9	3996·0
Tops, .	2·26	1·13	32·48	5·38	6·45	4·74	33·68	2.57	90·4	—
Total, .	102·70	1·13	38·99	22·49	34·35	18·52	44·84	13·35	615·3	?

Agricultural Statistics.—The introduction of a bill into Parliament to facilitate the collection of Agricultural Statistics, and its subsequent withdrawal, may be regarded as testifying to two facts—the need that is felt for such statistical information, and the difficulty of devising a proper method of obtaining it. In regard to the former point, we do not well see how there can be much diversity of opinion. That the government should be accurately acquainted with the resources of the country, in order that they may administer them advantageously, or adopt any measure which is to exercise an important influence upon them, is so obvious, as a

* As starch.

general principle, that it will at once be admitted. Were it otherwise, especially in the matter of food, the government would be in the position of a beleaguered garrison taking some decisive step, such as to resist or to surrender, without adopting measures to ascertain, or possessing the means of ascertaining, the state of their provision and stores. Nay, so obvious is the utility of such knowledge, that it is difficult to understand how the government of such a country as this has hitherto been left without any effectual means of acquiring it. All the principal food-rearing countries have some method of determining the amount of their produce; and the principle has long been recognised and acted upon in our manufacturing and other commercial operations. In regard to all these, we are furnished with precise statements and trustworthy data, which enable us, almost at any time, to ascertain the exact condition of any one department of national industry; the results of our agricultural operations are alone left to speculation and conjecture.

It is scarcely necessary to refer to the event by which this fact was so strongly, and painfully, brought home to our convictions. The simultaneous failure of the potato crop, and deficiency of the general harvest, in 1846, rendered it highly desirable to ascertain the amount of food in the country, in order to know the extent of the deficiency which it was necessary to supply. The means of doing this were unhappily wanting, and hence the extensive speculations which proved ruinous to thousands. And a similar result is likely to happen on future occasions, if some method be not adopted for determining the real state of our supplies. Such information as is now to be obtained on this subject, is often more calculated to mislead, than to guide us to a proper mode of acting. It is either founded on partial and inaccurate observation, or it emanates from interested parties, with the express intention to deceive. The more mystification prevails, the greater scope is there for the operations of those who least of all desire a fair market. From the nature of the subject, too, it is impossible that any general calculation, or conjecture, would in any useful degree approximate to the truth. In every light in which we can regard it, therefore, this statistical information seems most desirable. It would have a tendency to render the price of food more stable—to prevent food riots, from unfounded apprehensions—to keep speculators within reasonable bounds: when favoured with abundant harvests, it would enable us to appreciate more fully the extent of the blessing; and in seasons of adversity, it would show us precisely the amount of the evil with which we had to grapple.

The late proposed bill went but a short way to supply the desideratum. All that it provided for was, to ascertain the amount of acres occupied by bread crops, and the number of cattle, sheep, &c., reared on the different farms. But all this might be deter-

ained, and w l still be very far short of the requisite knowedge. In or r years, it is true, from knowing the number of acres under crop, we might form a pretty fair estimate of the average amount of produce. But owing to the character of the season, he productiveness of a given area may vary to an immense extent—from 40 to a 100 per cent—and this it affords us no means of ascertaining. And it is to be observed, that it is in extraordinary seasons, in exceptional cases, that accurate information as to the amount of produce is most needed. For what is most urgently required, therefore, the bill makes no provision; it fails us just on those occasions when the exigency is greatest. It was proposed, moreover, that its operation should be limited to England; and yet the expense of the machinery for carrying it into effect was estimated at no less than from £30,000 to £40,000! It was proposed to fix the charge of the expense upon the poor-rates, in the respective localities—a proposition which gave rise to much opposition, as an additional burden would thereby be laid upon the farming interest. It seems most equitable that a measure intended for the public at large, should be provided for out of the public funds.

In order to meet the necessities of the case, it is obvious that, besides ascertaining the number of acres annually sown, some provision should be made for determining annually the amount of produce. This is certainly by far the most difficult part of the inquiry, but without it any other would be of comparatively little advantage. On looking for a quarter from which this information might be obtained, we are naturally led to think of the farmers themselves. They are obviously the parties most competent to supply it; and is there anything inconsistent with their interests, or hurtful to their feelings, in doing so? We cannot see that there is. If, indeed, such details as are wanted, in regard to each particular farm, were to be laid before the public, the investigation would at once assume a personal and inquisitorial character of the most objectionable kind. A public exposition of the cultivated area and probable yield of his farm, would be interfering so directly with private interests, that we could not expect any farmer to sanction, much less to promote, such an insidious measure. But the details, in this case, would never meet the public eye: they are all supplied to the government for the purpose of enabling them to get at the gross result; it is with the latter alone they have to do, and which alone they would make public. They could have no motive, because there could be no utility, in publishing the specific details; these would remain in the government archives, secure from intrusion. This being the case, no conceivable injury could arise to individuals, from undue publicity given to their affairs. But it may be alleged that, before the information reach the quarter for which it is ultimately intended, it must pass through the hands of others, for whose discretion we have no guarantee. In the machinery to be employed for collecting, and it may

be, digesting, the materials, provision would require to be made against this; and it may be easily rendered effectual. The collection of the income-tax seems particularly open to a similar objection, yet we have never heard of any particular abuse arising out of it. Farmers might receive some recompense for the trouble this would occasion them; but it would often be an advantage to themselves, to form an estimate of the yield of their crop, and the condition of their stock, either before or after harvest, which would go far to reward them for the trouble. It might be necessary, also, to have some means of checking their returns, or correcting their estimates, especially when the measure first came into operation, or in years of unusual character; but from the knowledge they may be supposed to possess of the yield of their crops, and the want of all motive to mislead—from the utter absence of individual cases by which personal interests might be compromised, not to speak of the penalties with which the legislature would not fail to visit any disregard of its injunctions, their returns might be regarded as fairly entitled to confidence.

It is, of course, not very easy to obtain an accurate knowledge of the yield of a crop while it is still growing in the field, yet a wonderfully close approximation can be made. Occasions often arise in which such an estimate requires to be formed—as when an outgoing tenant hands over his crops to his successor, when a growing field is to be purchased, &c.—and the result is generally not far from the truth. When the crop is gathered into the stack-yard, a still more correct idea can be formed; for the bulk is then ascertained, and a partial thrashing affords the means of judging of what is left in the straw.

Most of the writers whom we have seen on this subject confound two things essentially different—namely, the statistical question, properly so called, and the resources of the country. The latter are not called in question; they are happily great and progressive, and every means for their further development is, no doubt, deserving of our most careful attention. But there is no reason why the two things should be mixed up. What the statistical view of the question aims at is, the means of determining, at any given time, the precise extent of our resources, whether these be great or small; how they are to be increased is an important, but altogether different matter, and requires an entirely different set of provisions.

In a very clearly conceived, and clearly expressed pamphlet, on Agricultural Statistics, free from the questions with which so many others have embarrassed the subject, by Mr Milburn,* such strong objections are anticipated on the part of farmers, that their

* [illegible] Right Honourable Viscount Morpeth, on the necessity for, and mode [illegible] Agricultural Statistics. By Matthew M. Milburn.

agency in collecting the requisite information, is not recommended. Speaking in reference to England, he suggests the following plan, which we give in his own words:—

Let a commission be appointed, attached either to the Board of Trade, Registrar-General's, or the Poor-Law Commissioners' Office, or even an independent office, provided with clerks, &c. At a particular day, say June 30th, in each year, let a form of notice be sent through the overseer of the poor, who has now but few duties, to each occupier of land in the Kingdom exceeding three acres, with instructions for him to fill up the acres he has growing corn and other crops, and stating the number of feeding and holding stock he possesses.

Then, for each poor-law union, let a valuator be appointed by the government, who shall on a certain day commence and take these returns, either in detail from the overseer, or in a summary to be made by him; and let him make an inspection of the crops in each township of the union, and deliver in an estimate of the average produce, say by the 30th of July. This is to be attached to the schedules, and returned to the central office by the valuator, within a certain day; and the officer and clerks of the central establishment shall calculate the whole. An aggregate would thus be obtained from correct and irrefragable data, and yet no occupier's secrets would be betrayed, either to the government, to the landlord, or his neighbours, the valuator making a return only for the aggregate township.

The cost of this measure would be comparatively trifling: the overseer of the poor acting as distributor, the enumerators would thus be saved. The payments of the superintendent registrars would also be avoided, and beyond the simple office expenses, necessary to any return whatever, there would be no payments except to the valuator. This would be much less costly than the machinery of the bill of last Session.

Assuming the poor-law unions to average an area of 80,000 acres each, and the average number of occupiers, of above three acres, to be twenty for every thousand acres, or 1,600 occupiers in the whole, the cost of enumerators would be £40, and the charge of the superintendent registrar would be £4, so that the sum of £44 would be expended to ascertain the average of the union. Now, as there would be scarcely 20,000 acres of corn in the assumed area, in any union, and as the grass-land crops would not have to be valued, the valuator might very easily form his estimate in ten days—eight for the view, and two for the calculation: this, at three guineas per day, would amount to £31, 10s.; or if an additional allowance were made for expenses, it would still be within the sum charged for the enumerators, and supply an impartial, clear, and accurate estimate of produce on which to base any measure which might be required for the safety or advantage of the community, in times of scarcity."—(P. 11-13.)

We do not think that very great difficulty would be experienced in obtaining such returns in Scotland. Were the co-operation of the farmers secured, as we think it easily might, some of the existing machinery now employed for other purposes might be made available for distributing schedules and collecting the returns. The appointment of a general valuator for particular districts might, however, be necessary, and this would entail some expense, but by no means considerable, when we consider the advantage to be gained.

In a pamphlet by Mr Fleming,* the reader will find a variety

* *The Policy of a National System of Agricultural Statistics; with practical Suggestions for increasing the Agricultural Produce of the Kingdom.* By Harris Fleming, Esq.

of materials collected, bearing more or less on the present question, the perusal of which may assist him in forming an estimate of its merits. He chiefly refers, however, to the means of increasing our agricultural produce, which he thinks may be done, 1st, By the reclamation of waste lands; 2dly, By the reconstruction of fences throughout England; 3dly, By the economy of seed, in the adoption of thin sowing; and, 4thly, By a continuous improvement in our tillage system.

Richardson on the Horse.—Prosecuting his praiseworthy endeavours to afford to agricultural readers cheap and useful information on the subjects in which they are professionally most interested, Mr Richardson has issued another of his neat little volumes, which treats of the horse. Not only does he discuss its natural, and what may be called its artificial history—that is, the various races and peculiarities which have resulted from domestication and human interference—but he takes up the subject of stable-management, breaking, training, and treatment of disease. The volume, therefore, forms a very useful epitome of all that is most interesting in relation to this animal; and similar commendation may be extended to all the other volumes of the series.

From an Irish author we naturally look for special information respecting the national breeds of his own country, which are well known to be somewhat peculiar in the case of the horse. We should be inclined to think that the origin of the proverbial saying alluded to in the following extract is of older date than is there assigned to it.

Ireland also possesses an indigenous breed of horses; some say *several*, but we are disposed to imagine that but *one* breed is properly entitled to be regarded as primitive, the others being merely variations, resulting from crosses and subsequent neglect. These horses are of small size, but of good form, very strong in proportion to their stature, active, and of excellent constitution. These were popularly called *Hobbies;* they were formerly in much esteem, both in their native country and in England; and so great was the mania for possessing them, which at one time existed almost universally throughout the British islands, that their name became afterwards proverbially applied to every object on which an individual placed inordinate affection. "He is on his hobby," is an expression too familiar to require the reader to be more than reminded of it.

Many of the old writers speak in complimentary terms of these little horses, and bear testimony to the high degree of estimation in which they were formerly held. Both Strutt and Campion have recorded their value in their works, as witness the following passages:—"Horses they have of pace easie, in running wonderful swift. Therefore they make of them great store, as wherein at times of need they repose a great piece of safetie." "I heard it verified by honourable to honourable, that a nobleman offered, and was refused, for one such horse, an hundred kyne, five townlands, and an eery of hawks yearly, during seven years." It has been asserted that the climate of Ireland is too moist to be favourable to the breed of horses. The only reply that we can give to this assertion is a practical one—look to these "hobbies,"

the indigenous breed of the country, ere we possessed the advantage of crossing from English or foreign stocks, so highly valued everywhere.—(P. 36.)

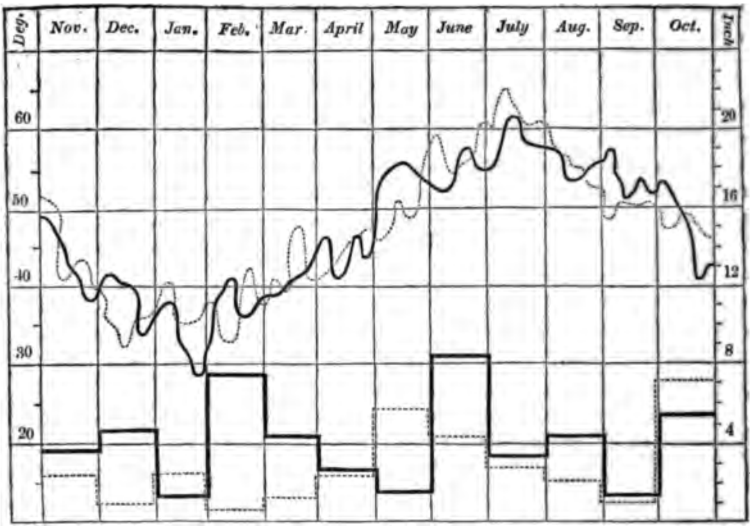
It is nevertheless true that the moistness of a climate has a most unfavourable influence on the qualities of the horse. It is from this cause, and the plentiful vegetation which results from moisture, and consequently the nature and abundance of their food, that such heavy massive forms are produced in western Europe, well fitted, it is true, for draught and burden, but destitute of nearly all the nobler qualities. Yet a dry climate, and a peculiar kind of food, if these influences are sufficiently prolonged, are capable of changing such an animal—a Flemish or a London dray-horse—into a mettled Arabian,—

With a champing bit, and an arching crest,
And an eye like a listening deer,
And a spirit of fire that pines at rest,
And limbs that mock at fear.

If a London dray-horse be conveyed to Arabia, and subjected to the same influences to which the native horses of that country are exposed, it will, in the course of some generations, present the leading characters of an Arabian horse. The head will gradually diminish in size, the limbs will become fine and clean, the massive proportions of the whole body will disappear, and not only will the external form of the native horses be acquired, but, along with that, something also of their chivalrous disposition. If the race, thus improved, be again conveyed to Europe, it will gradually deteriorate, and, in the course of some generations, will again acquire all its original properties. This fact, which we state on the authority of Professor Pictet of Geneva, seems to prove that the Arabian horse cannot exist in perfection in this country, or in any other of the western countries of Europe; and there can be little doubt that the humidity of the climate, and the influences indirectly arising from that cause, are the principal reasons of this.

Thermometrographia for the Agricultural season ending with October 1848.—From observations made at Annat Cottage, Perthshire; N. Lat. 55° 56′; elevation above the level of the sea, 170 feet; exposure S.E.

The dark-waved line in the accompanying wood-cut, is laid down from figures recording the weekly means of temperature. As compared with the dotted line, which refers to the previous season, it shows, by reference to Fahrenheit's scale in the left hand-column, a severer winter, and a warmer May and September; while, by being so much under the dotted line in June, July, and August, it brings to mind a cool and backward summer. Compared with a cyclical mean, May is the only month in which the past growing season had a decided advantage, and, had it not been for the



astonishing progress which vegetation made in May, the bygone season would have been much later than it actually was. The frost in October is evidently marked.

The monthly fall of rain for the two seasons is shown respectively by the black and dotted lines in the lower part of the diagram. These lines bear reference to the scale of inches in the right-hand column.

Mean temperature for the year ending with Oct. 1848,				47·09°
do.	do.	do.	1847,	47· 1°
do.	do.	on a cyclical average,		47. 7°

Fall of rain, 49·99 inches; previous season, 35 inches; cyclical average, 27 inches. Mean temperature of the growing season, from March 20th to October 20th=52·5 degrees, or 12·5 degrees above the vegetating point.

ANNUAL AGRICULTURAL REPORT.

December 1848.

The year 1848 will afford a memorable page in the history of Europe. While many nations have been distracted by political convulsions, Britain has only been visited by meteorological eccentricities. What the ultimate effect of those convulsions may be, produced as they have been by the unbridled passions of men, we cannot anticipate, but the effects of atmospherical disturbance, however eccentric, may be estimated, because produced by the recognised laws of nature.

We have only to look at the crooked lines engraved on the figure on the last page, to ascertain what the meteorological eccentricities of the year that is about to close, have been; and one need not look beyond the period embraced between January and October, the period of active vegetation. On comparing the course of the square black line with that of the curved line, in the

espective months, it will be seen that January was cold and dry, indicating a good approaching seed-time. February proved fresh and very wet, interfering with the spring-wheat and bean seed-time. March was drier, though still wet and fresh, and unfavourable to a good oat-seed. April still drier and higher in temperature, and favourable for the barley seed. May proved the driest, warmest, and most beautiful month of the season; and, indeed, its three weeks of fine weather constituted the only summer we enjoyed. The sudden heat and drought after the rain rendered the land hard to work; on which account, the Swedish turnips by no means received a favourable seed-bed. A severe thunder-storm in the early part of June, broke the spell of the fine weather, and immediately after, June proved a very wet and cold month. July, though not so wet or quite so cold, was equally unseasonable. The rain and cold increased in August considerably. September was as dry as January, and the temperature was about that of August, and allowed a large part of the crop to be carried in good order. October, usually a bright and pleasant month, proved wet, and the frost became intense for several days in succession. The heat of May tended powerfully to raise the average thermometrical temperature of the season, though the weather was always cold to the feelings; but its character was decided throughout for extraordinary wetness, the fall being in the ratio to last year of 49·99 inches to 35 inches.

Now, no difficulty exists in indicating the effect of such a season, as thus characterised, should have upon the crops. The heavy rains of February rendered the land very wet from the commencement of the sowing season; and March, which is usually a dry month, contributed more than the average monthly quantity of rain. In these circumstances, spring-wheat, beans, and oats were sown in an unfavourably wet state of the ground—quite the opposite of last year. April was better for the finishing of the oat seed, and the commencement of the barley seed; while the drought in May affected the braird of both oats and barley—the former having been attacked by the grub, and in the latter the germination was partially checked in embryo, as was also the case with some of the swedish turnips, of which that brairded in the drought was attacked by the fly, and caused the crop, in many cases, to be re-sown. The rain of June, while it brought forward all the brairds, interrupted the continuance of sowing of the white and later turnips. Notwithstanding the dull cold days of June and July, the vegetation of all the earlier crops of grain, and even the turnips—though then late, and frequently interrupted in the singling and hoeing—was rapid and full, and secured abundance of fodder.

It was reasonably apprehended that the harvest would be a late one; but, contrary to all surmises, the wheat was ready to be cut by the middle of August. This early maturity was no doubt greatly to be ascribed to the forcing of the elaboration of the sap by the heat of May; and the plant having then been pushed prematurely forward in that stage of its growth, came more rapidly into ear and towards maturity than was expected. The warmth imparted to the ground in May, and the retention of the heat in it in consequence of drainage, tended strongly to render the wheat of finer quality in the best class of soils; while the late-sown spring-wheat, and that on coarse soils, proved inferior in quality. The barley, having been rapidly brought forward, proved good; and as oats absorb a great deal of moisture, they have also yielded a good crop. The beans are more bulky in straw than prolific in grain. The cold sharp air in October rendered the straw so apparently dry in the stook as to induce many farmers to carry it into the stack-yard before it was entirely won, and heated stacks was the consequence in many cases. The weight of grain varies very considerably this season.

Potatoes, thriving in moisture, have produced a large yield. The disease appeared amongst them again to a considerable extent, but in what proportion we cannot say—although we had more difficulty in this than in last year of procuring a good potato for the table. We suspect that the farmers are less disposed to complain aloud of their loss, from this crop, than in former

years. They must now see that no dependence can be placed on the potato as an article of food, or as an easily-raised prolific crop. Still a great reluctance exists against banishing it from the fields; and as the early sorts have escaped, comparatively, from disease, it is probable that more attention will, in future, be given to them than to the later kinds. Some farmers have already planted early potatoes in the field with success—that is, without disease; and being ready for an early market, the return realised by them has been considerable. Perhaps the ash-leafed kidney is the best early potato for the field; and although not a prolific variety, it will yield a sufficient quantity for all the purposes to which the potato should be used, by the people for their own consumption—namely, as an accompanying or alternating vegetable to more substantial fare. Until the custom of depending on the potato as the sole means of subsistence is abandoned by the work-people, famine will never cease from the land.

The turnips are an unequal crop, being, in many parts of the country, small and bearing little eating, and in other parts they are excellent. The disparity can be easily accounted for. Those who sowed early and escaped the fly have a good crop; and those who had to re-sow or sowed late have one of small bulbs. The smallness of the bulbs, however, is not a consequence of the late sowing, for there was plenty of time for the crop before November to grow to a proper size: it was occasioned by the dry weather in the end of September, which occasioned a little mildew; this was followed first by cold rain, and then intense frosts in October, the very period in which the turnip bulb swells to maturity—both causes stinting the growth in the best season.

The hay crop was much superior to that of last year. The moist March promoted the early growth of the grasses, and the bright weather in May enabled much of the hay to be stacked without a shower. For the same reasons, the pasture was good and continued to grow through the season, and perhaps the hill pasture was never better.

The demand for sheep, in more than fair condition, from the south, has been very great. The southern counties were cleared of all their draft stock by the end of September. The demand may have arisen partly from a good aftermath, and partly, we suspect, from the effects of the epidemic now felt, of two or three years since, when severe losses were sustained in flocks. A new disease amongst sheep, the small-pox, has been imported from abroad; and so great has the alarm been created of this disease, that legislative measures have been passed with a view to prevent the circulation of marked cases of disease.

The season in England has not been so favourable for the corps as in Scotland; and the consequence has been inferiority of quality, and deficiency in quantity of the cereal crops, especially in the south of England in the great wheat districts. The English farmers there are so little accustomed to interruptions in harvest, that when a bad season occursthey are unskilled in expedients to avoid its injurious effects. Barley and oats in the swath, have then a very poor chance of escaping irreparable injury. Oats being the principal crop in Ireland, a dripping season is always favourable to their growth.

Notwithstanding the acknowledged deficiency in the crop in England, the price of wheat is moderate, 51s. per quarter. The import duty being only 4s. or 5s. per quarter, the large importation that has already taken place from abroad, has not been bonded but entered for home consumption. The importation will no doubt continue, and, what is remarkable, the Baltic has not yet been blocked up with ice, and what is farther remarkable, the cargoes of wheat of last year's crop, after having been detained by embargo, by the Danish government, in consequence of its war with Germany, realised here much larger prices than their owners would have taken for them, had they been allowed to proceed to their destination at once—verifying once more the old proverb, "The colley only drives the hare to its meat."

TABLE OF PRICES, &c.

The Average Price of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
1848.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Sept. 2.	55	9	36	8	22	0	33	3	43	2	34	3
9.	58	3	37	4	23	0	34	0	44	4	38	2
16.	58	4	32	3	21	10	34	0	40	2	33	11
23.	55	0	34	10	23	4	34	9	38	1	33	9
30.	53	5	33	3	22	7	33	10	40	11	52	2
Oct. 7.	54	2	33	2	22	7	32	2	40	1	31	3
14.	52	7	31	10	20	5	32	8	42	6	31	4
21.	52	8	33	4	19	4	33	2	41	8	30	11
28.	51	4	33	5	21	0	33	0	42	2	33	4
Nov. 4.	52	1	33	8	23	10	29	9	43	4	33	7
11.	52	6	35	3	24	7	32	0	41	4	32	11
18.	53	10	36	4	22	3	33	6	42	8	37	5
25.	52	10	34	2	20	9	28	4	41	1	33	0

LIVERPOOL.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
1848.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Sept. 2.	58	10	34	6	24	5	32	4	36	7	40	0
9.	57	5	34	0	24	9	33	6	37	4	37	10
16.	55	0	33	4	23	5	34	0	38	6	34	6
23.	55	1	32	8	24	8	34	6	39	2	36	7
30.	54	10	30	0	24	2	34	2	40	5	36	4
Oct. 7.	52	2	31	6	23	6	33	8	42	4	40	3
14.	51	9	32	11	22	5	34	3	44	2	38	9
21.	51	10	31	7	21	7	33	2	46	6	35	0
28.	49	7	31	4	20	10	32	10	45	8	36	10
Nov. 4.	50	7	33	2	21	3	31	8	47	0	38	5
11.	50	4	34	0	20	7	30	9	48	0	34	7
18.	50	8	34	6	21	0	31	6	47	6	32	10
25.	49	8	34	2	21	3	30	4	46	2	32	9

EDINBURGH.

Date.	Wheat.		Barley.		Oats.		Pease.		Beans.	
1848.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Sept. 6.	55	4	32	0	24	6	38	7	38	1
13.	57	3	31	3	24	9	40	6	40	0
20.	59	6	31	7	24	2	40	4	39	6
27.	61	5	31	5	23	9	40	0	39	4
Oct. 4.	59	3	32	1	24	5	40	9	40	2
11.	58	5	32	0	25	0	40	4	39	8
18.	58	7	31	9	24	3	41	0	40	4
25.	56	3	32	1	23	9	40	7	40	0
Nov. 1.	56	4	31	9	22	7	39	5	38	4
8.	55	9	31	4	22	3	28	2	37	6
15.	54	4	30	3	21	6	38	6	37	9
22.	51	6	29	4	21	0	33	6	32	10
29.	49	7	29	3	21	0	32	6	32	0

DUBLIN.

Date.	Wheat, p. barl. 20 st.		Barley, p. barl. 16 st.		Bere, p. barl. 17 st.		Oats, p. barl. 14 st.		Flour, p. barl. 9 st.	
1848.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Sept. 1.	30	2	16	9	12	11	13	9	20	7
8.	28	11	16	2	13	5	13	2	20	1
15.	29	2	16	6	13	8	13	6	20	6
22.	27	0	15	6	13	9	13	0	20	4
29.	30	0	16	4	13	10	13	6	20	8
Oct. 6.	30	6	16	2	14	0	13	7	20	6
13.	29	4	16	0	13	9	13	4	20	2
20.	29	2	16	3	13	7	13	1	20	0
27.	28	8	15	10	13	4	12	9	19	10
Nov. 3.	28	4	16	0	13	6	12	6	19	4
10.	28	0	15	9	13	2	11	9	18	8
17.	27	6	15	9	12	10	10	8	18	1
24.	26	4	13	9	12	8	10	9	18	3

LE showing the Weekly Average Price of GRAIN, made up in terms of 7th and 8th Geo. IV., c. 58, d 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties payable on FOREIGN RN: the Duties payable thereon, from September 1848 to December 1848.

s.	Wheat.						Barley.						Oats.						Rye.						Pease.						Beans.					
	Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.	
8.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d
2.	55	5	51	2	6	0	32	1	30	6	2	6	22	6	21	6	2	0	32	2	30	8	2	6	38	11	36	5	2	6	38	8	36	11	2	6
9.	56	10	52	8	5	0	33	4	31	2	2	0	22	10	21	11	2	0	33	8	31	3	2	0	41	6	37	4	2	0	39	1	37	5	2	0
16.	53	8	53	4	4	0	33	3	31	9	2	0	22	2	22	1	1	6	33	5	31	11	2	0	40	2	38	3	2	0	38	10	38	1	2	0
23.	52	4	53	7	4	0	33	7	32	4	2	0	21	11	22	2	1	6	32	0	32	4	2	0	37	11	38	9	2	0	37	10	38	5	2	0
30.	52	9	53	10	4	0	33	3	32	10	2	0	21	1	22	1	1	6	31	9	32	3	2	0	39	8	39	4	2	0	36	1	38	1	2	0
7.	52	5	53	11	4	0	32	6	33	0	2	0	20	8	21	10	2	0	32	1	32	6	2	0	38	0	39	3	2	0	35	3	37	8	2	0
14.	51	11	53	4	4	0	32	0	33	1	2	0	20	9	21	7	2	0	30	4	32	3	2	0	39	2	39	5	2	0	35	2	37	1	2	0
21.	51	7	52	5	5	0	32	3	32	10	2	0	19	11	21	1	2	0	32	4	32	0	2	0	39	7	39	1	2	0	35	9	36	6	2	0
28.	51	0	52	0	5	0	32	7	32	8	2	0	20	4	20	9	2	6	28	9	31	2	2	0	40	1	39	2	2	0	37	8	36	3	2	0
4.	51	2	51	10	6	0	32	10	32	7	2	0	20	7	20	7	2	6	31	2	31	1	2	0	39	7	39	4	2	0	37	1	36	1	2	0
11.	52	0	51	8	6	0	33	7	32	6	2	0	20	10	20	6	2	6	30	5	30	10	2	0	40	2	39	5	2	0	37	2	36	3	2	0
18.	52	3	51	9	6	0	34	1	32	11	2	0	20	5	20	5	2	6	30	10	30	7	2	0	40	6	39	10	2	0	38	1	36	9	2	0
25.	51	6	51	7	6	0	33	2	32	1	2	0	20	2	20	6	2	6	30	9	30	8	2	0	40	8	40	1	2	0	36	10	37	0	2	0

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Date.	Markets.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
1848.		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sept.	Danzig	36 6 to	45	18	22 6	14	18 6	20	25	26	32	24	30
Oct.	do.	38 6	46 6	18 6	24	14	17	21 6	27	28 6	35	25	30 6
Nov.	do.	44	50	19	26	13 6	16 6	22	29	29	36	24	28 6
Sept.	Hamburg	45 6	52	22 6	31	13 6	18	23	31	25 6	32	26	34
Oct.	do.	42	49 6	21	28	12 6	16	21 6	28	25	30 6	24 6	32
Nov.	do.	37 6	43 6	20 6	25	11 6	15	20	26	24 6	29	21	28
Sept.	Bremen	45	52 6	19 6	28 6	14 6	20 6	26	30	27	34	25	30 6
Oct.	do.	42 6	50	21 6	29	13 6	18 6	27	31 6	26	32	24	29
Nov.	do.	40	48	20	27	12 6	17	25	28	25	31	24 6	30
Sept.	Königsberg	42 6	50	18 6	26 6	16	21 6	19	24 6	26 6	34	24	32
Oct.	do.	40	48	19 6	28 6	15	19 6	20	26	27	36	25	32 6
Nov.	do.	38 6	46	20 6	29	14 6	19	22	28	25	32	22	29

Freights from the Baltic were from 3s. 6d. to 6s., and from the Mediterranean, 7s. to 11s. 6d. per imperial quarter.

THE REVENUE,
From 10th October 1847 to 10th October 1848.

	Quarters ending October 10.		Increase.	Decrease.	Years ending October 10.		Increase.	Decrease.
	1847.	1848.			1847.	1848.		
	£	£	£	£	£	£	£	£
Customs	4,936,644	5,406,483	469,839	..	18,418,157	18,358,827	..	59,330
Excise........	3,539,946	4,102,574	562,268	..	12,092,108	12,825,861	733,843	..
Stamps	1,707,945	1,461,942	..	246,003	7,135,378	6,203,105	..	932,273
Taxes	213,885	215,656	1,771	..	4,329,677	4,308,474	..	21,203
Post-Office....	222,000	221,000	..	1,000	859,000	786,000	..	73,000
Miscellaneous	73,126	33,923	..	39,293	269,837	198,998	..	7,839
Property Tax	1,918,645	1,892,890	..	25,755	5,438,453	5,385,498	..	52,955
	12,612,191	13,334,468	1,033,878	312,051	48,542,610	48,066,763	733,843	1,146,600
	Deduct Decrease		312,051		Deduct Increase			733,843
	Increase on the qr.		721,827		Decrease on the year			412,757

TABLES OF BUTCHER-MEAT.

Date.	LONDON. Per Stone of 14 lbs.				LIVERPOOL. Per Stone of 14 lbs.				NEWCASTLE. Per Stone of 14 lbs.				EDINBURGH. Per Stone of 14 lbs.				GLASGOW Per Stone of 14		
	Beef.		Mutton.		Beef.		Mutton.		Beef.		Mutton.		Beef.		Mutton.		Beef.		Mu
1848.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s.d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sept.	5 6 to	7	6 9 to	8 9	6 to	7	6 3 to	7 3	5 9 to	6 6	5 6 to	6 3	6 3 to	7	6 to	7	6 6 to	7 6	6 3
Oct.	6	7 3	6 6	8 6	6 3	7 3	6 6	7 6	6	6 9	5 9	6 6	6 3	7 3	6 3	7 3	6 6	7 6	6 3
Nov.	6 3	7 3	6 6	8 6	6	7	6 3	7 3	5 6	6	5 6	6	6	7	6	7	6 3	7	6

PRICES of English and Scotch WOOL.

English, per 14 lbs.

	s. d.	s. d.
Merino, ...	11 6 to	15
in grease, ...	9	11
South Down,......................	11 6	15
Half-Bred,........................	9	12
Leicester Hogg,..................	9	12
Ewe and Hogg,................	8	10
Locks	5	7
[illegible]	[illegible]	6

Scotch, per 14 lbs.

	s. d.	s. d.
Leicester Hogg, ...	9 to	12
Ewe and Hogg, ...	8	10
Cheviot, white,....................	7	9 6
Laid, washed, ...	5	8 3
unwashed,................	4	6
Moor, white,.........................	4 6	6 6
Laid, washed, ...	3 9	4 9
unwashed,................	3	4

LEGISLATIVE MEASURES OF THE SESSION OF 1848 RELATIVE TO AGRICULTURAL AFFAIRS AND RURAL IMPROVEMENT.

THE following is an analysis of the various acts, public and local, passed in the last session of Parliament, relating to agricultural affairs and rural improvement. Three of the measures, it will be seen, are exclusively operative in Scotland, two in England, one in Wales, four in England and Wales, four in Great Britain, seven in Ireland, and three in the United Kingdom.

Entails of Land.

The purport of this act, (entitled "An Act for the Amendment of the Law of Entail in Scotland,") which received the royal assent on the 14th of August, is to assimilate the law of Scotland, with regard to entails, to that of England. By the law of England, estates may be tied up from alienation for a life, or any number of lives in being, and for twenty-one years afterwards; the practical result of which is, that family estates are resettled when the eldest son attains his majority: whereas the law of entail, as it has hitherto existed in Scotland, has been not only injurious to private individuals, but to the public interests also, and especially to the interests of agriculture, by tying down property, and keeping it out of the market. In the progress of this important measure through the Upper House, it was admitted by many noble lords connected with Scotland—particularly the Dukes of Buccleuch, Argyle, and Montrose, and the Earl of Minto—that serious inconveniences prevailed under the then existing system, and that great and general satisfaction could not fail to ensue from the adoption of a principle which went to assimilate the Scotch law of entail to the law of England. This sentiment was moreover echoed from the throne on the prorogation of Parliament, when Her Majesty thus specially alluded to the subject:—"The system of perpetual entails of land, established in Scotland, produced very serious evils both to heirs of entail and to the community, and I have had great satisfaction in seeing it amended, upon principles which have long been found to operate beneficially in this part of the United Kingdom."

In the preamble to the act, after declaring "that the law of entail in Scotland has been found to be attended with serious evils, both to heirs of entail and to the community at large," and that it is expedient the same be amended, &c., it is enacted that where any estate in Scotland shall be entailed by a deed of tailzie, dated on or after the 1st of August 1848, it shall be lawful for an heir of entail, born after that date, to disentail the estate on application to the Court of Session, and recording the instrument of disentail

in the register of tailzies, in the form set forth in a schedule appended to the act; and any heir of entail, born before such date, may do so with the consent of the heir next in succession, such heir being "of the age of twenty-five years complete, not subject to any legal incapacity, and born after the date of the tailzie to which such instrument applies." The next clause enacts, that an heir in possession under an existing entail, born after the 1st of August 1848, may execute an instrument of disentail; and, if born before that date, he may do so without the consent of the heir next in succession, such heir being "heir apparent under the entail of the heir in possession, born after the 1st of August 1848, and of the age of twenty-five years." By the third clause, an heir of entail in possession may disentail, provided such heir be the only heir of entail in existence for the time, and unmarried, or shall have obtained the consents of the whole heirs of entail, if there be less than three in being at the date of such consents, and at the date of presenting such application; or shall have obtained the consents of the three nearest heirs who are entitled to succeed to such estate in their order, successively and immediately after such heir in possession; or shall have obtained the consents of the heir apparent under the entail, and of the heir or heirs, in number not less than two, including the heir apparent, always providing the latter be under twenty-five years of age. The like consents will also empower the heir of entail "to sell, alienate, dispone, charge with debts or incumbrances, lease and feu" an entailed estate, in whole or in part, according to the tenor of such consents. An heir of entail, under an existing entail, may also excamb the estate in whole or in part, with the consent of the three nearest heirs. Applications to disentail must be accompanied by an affidavit, setting forth the particulars of any debts, annuities, or other charges that may exist on the part of the entailer, affecting the fee of the entailed estate. A subsequent clause debars heirs in possession, who shall have borrowed money previous to the passing of this act, from giving any consent in opposition to creditors in debts now existing. A similar restriction extends to heirs apparent who may borrow money after the 14th of August last, on security or right of their succession. The following clause, which has also reference to the same subject, declares, that any creditor of an heir of entail in possession, "who is by this act empowered by himself alone, without the consent of any other party, to acquire such estate in fee simple, by executing and recording an instrument of disentail as aforesaid," shall be empowered to affect such estate for payment of debt. By a subsequent clause, a creditor is restricted from selling land in excess of what is necessary to pay his debt and expenses; any surplus remaining, if it exceed £200, is to be reinvested in other lands, to be added to the estate; but if the surplus be less than £200, then it is to be paid over to the heir of entail for his own use and

behoof. Creditors of entailer are not to be affected in their rights, if inhibition, in reference to their claims, be recorded before the expiry of one year from the date of the instrument of disentail. The clause referring to settlements by marriage-contract being an extremely important one, we give it entire :—

"And be it enacted, that where any heir of entail in possession of an entailed estate in Scotland, holden by virtue of any tailzie dated prior to the said 1st of August 1848, or the heir apparent to such estate, shall, together or separately, have secured, by obligation in any marriage contract, the descent of such estate upon the issue of the marriage in reference to which such contract is entered into, it shall not be competent for such heir of entail in possession, or heir apparent, or either of them, to apply for or consent to the disentail of such estate, until there shall be born a child of such marriage capable of taking the estate in terms of such contract, and who, by himself or his guardian, shall consent to such disentail; or until such marriage shall be dissolved without such child being born, unless the trustee or trustees named in such contract, or the party or parties at whose sight the provisions of the contract are directed to be carried into execution, shall concur in such application or consent.

By the 12th clause, it is enacted that two acts—one passed in the reign of Geo. III., for encouraging the improvement of entailed lands, tenements, &c., in Scotland; and the other in the reign of Geo. IV., for authorising the proprietors of entailed estates in Scotland to grant provision to their families—are not to be deemed applicable to any tailzie dated on or after the 1st of August 1848. In cases where an heir of entail in possession, (holding prior to the 1st of August 1848) shall have executed improvements on the estate previous to the passing of this act, and shall have obtained a decree for three fourth parts of the sum expended thereon, it shall be lawful for such heir to execute, in favour of any party he may think fit, a bond,—

Binding himself and his heirs of tailzie to make payment of an annual rent during the period of his own life and twenty-five years thereafter—such annual rent during his own life, not exceeding the legal interest of the said three fourth parts of the sums expended as aforesaid; and during the twenty-five years after his decease, not exceeding the sum of £7, 2s. for every £100 of such three fourth parts as aforesaid, and so in proportion for any greater or less sum, and such annual rent being payable by equal moieties half-yearly, at the terms of Whitsunday and Martinmas." [And by the succeeding clause, a similar power is given to heirs of entail in possession, for any improvements effected "subsequent to the passing of this act.]

In cases where the heir of entail having executed improvements on the estate, "and died without having executed a bond of annual rent," it shall be lawful for his executor or personal representative, to make application by summary petition to the Court of Session, praying the court to decern the heir in possession to execute, in favour of any party such petitioner may think fit, a bond of annual rent in terms similar to those expressed in a foregoing clause. Where the heir of entail in possession has executed improvements on the estate (whether prior or subsequent to the passing of this act) agreeably to the Act 10th Geo. III., but has not obtained a decree for the expenses, application may be made by summary petition, praying the court for authority to grant

bond of annual rent. No bond, however, can be made the ground of adjudication, "so long as any entailed estate remains subject to the tailzie thereof, or is not liable to be disentailed by the heir of entail in possession, without the consent of any other party." The annual rents to be recoverable as accords of law, out of the rents and profits of the entailed estate, and from the heir in possession for the time being. Creditor to have no remedy for arrears beyond two years' annual rent and interest thereon, and corresponding penalties. Heirs in possession who may be called upon to grant a bond of annual rent, may charge the fee and rents of entailed estate, "other than the mansion-house, offices, and policies thereof," with two third parts of the sum on which the amount of such bond of annual rent, if granted, would be calculated in terms of this act, by granting, in favour of any creditor who may advance such two third parts, bond and disposition in security over such estate until the loan is repaid; such bonds of annual rent and dispositions in security for improvements, to operate as a discharge of all claims against the estate. Private roads made through any entailed estate, or by way of immediate access thereto, to be deemed improvements, "in the same way and manner in all respects as inclosing, planting, and draining." Provisions to younger children may be made charges upon the entailed estate by bond and disposition in security. The heir in possession, "and the heirs subsequent to him in their order successively," to be bound to keep down the interest on all such bonds and dispositions in security accruing during their possession respectively. The remedy competent to the creditor to be limited to the principal sum expressed in the bond, with two years' interest thereon. Provisions to children are not to be charged without authority of the court; application to which to be accompanied by a schedule, setting forth the specific portion of the estate proposed to be charged. The 24th clause refers to the power to grant feus or long leases, and enacts that it shall be lawful for an heir of entail in possession, (notwithstanding any prohibitory, or other clauses contained in any tailzie dated prior to the 1st of August 1848,) upon notice to the heir of entail next entitled to succeed to the estate, "to grant feus or long leases of any part of the said entailed estate, for the highest feu-duty or rent that can be got for the same, such feus or long leases not exceeding in all one eighth part in value for the time of such estate; provided always that it shall not be lawful for such heir to take any grassum, or fine, or valuable consideration, other than the tack duty or rent, for granting any such feu or lease, nor to grant any such feu or lease of the mansion-house, offices, or policies of the estate." The concluding sentence of this clause contains a reservation, to the effect that "nothing herein contained shall prevent, or be construed to prevent, any heir of entail in possession from exercising any power of granting feus or leases which

may be contained in the tailzie under which he possesses, more extensive than the power of granting feu or leases hereby conferred." The 25th clause gives power to the heir in possession, where an entailed estate is charged with debt, to dispose of any portion of the estate," other than the mansion-house, offices, and policies thereof," which may be necessary for the purpose of paying off such debt. Any surplus that may remain, if more than £200, to be either invested in other lands to be added to the remainder of the estate, or be laid out in payment of entailer's debts, or towards payment of any money charged on the fee of the entailed estate, or in redemption of the land-tax affecting such estate, or in permanently improving the same, or in repayment of money already expended in such improvements, "as may be deemed most advisable." If, however, such surplus be less than £200, the same is to be paid to the heir of entail in possession, for his own use and behoof, "all at the sight and under the direction of the Court of Session." By the subsequent clause, it is enacted, that money arising from the sale of any portion of an entailed estate, as well as trust money, may (if it exceeds £200) be applied, under the authority of the court, in payment of entailer's debts, or in such other ways as are notified in the preceding clause; but if the amount happen to be under £200, then it is to be paid to the heir of entail in possession, for his own use and behoof. The succeeding gives power to deal with money vested in trust for the purchase of land as if it were the entailed estate. The date at which the Act of Parliament, deed, or other instrument, &c., for placing money or other property under trust, first came into operation shall be deemed to be the date at which land should have been entailed in terms of the trust," and shall also be held to be the date of any entail to be made hereafter in execution of the trust, whatever be the actual date of such entail. The 29th clause authorises the granting of provisions to wives and children out of money vested in trust for the purchase of lands to be entailed. Where any heir of entail, whose consent is required under this act, shall be under age, or subject to any legal incapacity, it shall be competent for the Court of Session to allow the guardians of such minors to give consent on their behalf; provided always "that no heir of entail in possession of an entailed estate in Scotland, or whose own consent shall be required in the application, shall be entitled to give consent on the behalf of any other party, in reference to any application for disentail of such estate." An heir of entail in possession, desiring to take advantage of any of the provisions of this act, must make application to the Court of Session by summary petition, an intimation of such intended petition to be made in the minute book, and on the walls in common form, and to be publicly advertised once in the *Edinburgh Gazette*, and once weekly for six successive weeks, or longer if the court shall deem fit, in any news-

papers it may authorise; the advertisements to contain merely the the name of such lands by which they are commonly known, without any detailed description; after such procedure, the petitioner may move the court to grant his prayer, and, provided there be no opposition, a decree may be issued. No heirs of entail, other than those whose consent would be required by the heir in possession for the time to an instrument of disentail, will be permitted to appear or be heard in any proceedings under this act. The 37th clause dispenses with the provisions of the 6th and 7th of William IV. in reference to excambions, and enacts a more simple and economical mode of proceeding—namely, "that from and after the passing of this act, it shall be competent to the heir of entail to present an application to the Court of Session by way of summary petition in the form provided by the act, and the court shall entertain the same accordingly; the register of tailzies to be deemed the only record necessary of any contract of excambion. Instruments of disentail (which may be registered in the registers of sasines) to be deemed final where the judgment of the Court of Session has not been brought under review of the House of Lords by appeal, or "under reduction upon any relevant ground during the period within which such judgment might have been appealed from." In future entails, it will not be necessary to insert any irritant or resolutive clauses conformably to an act passed in 1685; these will be considered as implied in the warrant to record. By a subsequent clause, the provisions of the act of 1685 are to remain in force except as affected by this act. Conveyances or other securities granted in reference to an entailed estate, are not to be affected by any irritancy committed on the part of the heir in possession. The 41st clause repeals the provisions of an enactment in an act passed in the reign of Geo. III., by which Scotland was excluded from its operation, and now declares, "that it is expedient that the provisions of the said act should be extended to heritable property in Scotland." [The act in question (39 and 40 Geo. III.) is entitled—"An act to restrain all trusts and directions in deeds or wills, whereby the profits or produce of real or personal estate shall be accumulated, and the beneficial enjoyment thereof postponed beyond the time therein limited."] Proceedings are permitted to be taken under this act by an heir in possession, whether the deed of entail be recorded or not, or whether the heir be duly infeft in such estate or not. Where an entail is found to be defective in any one prohibition (according to the terms of the act of the Scottish Parliament of 1685) it shall be deemed invalid as to all. No irritancy or forfeiture incurrable for anything done under this act. The 47th, 48th, and 49th clauses declare, respectively, that the enactments of this act shall not be defeated by any deeds of trust, liferent interests, or leases, dated on or after the 1st of August 1848. All consents of heirs of entail, or of their

tutors or curators, or other legal guardians under this act, to be in writing and irrevocable. The concluding clause authorises the Court of Session to pass such acts of sederunt as may be necessary for rendering this act more effectual.

Payment of Debts out of Real Estate.

In the first year of the reign of his late Majesty William IV., an act was passed "for consolidating and amending the laws for facilitating the payment of debts out of real estate;" and in which, among other things, it was enacted, that where any lands, tenements, or hereditaments should be devised in settlement by any person whose estate should be liable to the payment of his debts, and by such devise should be vested in any person for life or other limited interest, with any remainder, limitation, &c. over, which might not be vested, or might be vested in persons from whom a conveyance of the same could not be obtained, and a decree should be made for the sale thereof for the payment of such debts or any of them, it should be lawful for the Court granting such decree to direct the tenant for life, or other person having a limited interest, to convey the fee simple to the purchaser in such manner as the Court should think fit, such conveyance to be deemed as effectual as if the person executing it were possessed of the fee simple or other whole estate so to be sold. Now, as the provision in the above act does not extend to the case of lands, tenements, or hereditaments of a *deceased debtor*, it is the object of the measure passed in the last Session (August 31) to extend the operation of the Act of William IV. to all such cases; and with this view, the new act declares that henceforth the provision above recited shall extend "to any case in which any lands, tenements, or hereditaments of any *deceased person* shall, by descent or otherwise than by devise, be vested in the heir or co-heirs of such person, subject to an executory devise over in favour of a person or persons not existing or not ascertained; and, in any such case, it shall be lawful for the Court mentioned in the said recited provision to direct such heir or co-heirs, notwithstanding such heir or such co-heirs, or any of them, may be an infant or infants, to convey, release, assign, surrender, or otherwise assure the fee simple, or other the whole interest or interests so to be sold, to the purchaser or purchasers, or in such manner as the Court shall think proper." Such conveyance, &c., to be as effectual as if the heir or co-heirs were possessed of the fee simple of the whole estate, and the infant or infants were of full age.

Acts of Inclosure.

There were three Acts passed last session relating to the inclosure of lands. The first and most important (introduced by the Earl of

Carlisle) is one to "further extend" the provisions of the Act passed in the 8th and 9th of Victoria, for the inclosure and improvement of commons. These "extensions" are comprised in fifteen clauses; the first of which permits persons not interested in lands about to be inclosed, to apply to the commissioners to submit land to the operation of the proposed inclosure; and the same, if approved of by the commissioners, may be embodied in their provisional order. In the former act, it was enacted, that the map to be annexed to the valuer's report should comprise and show the lands in respect of which any allotments had been made; this having, it seems, "occasioned unnecessary expense in certain cases," is henceforth to be dispensed with. By a subsequent clause, it is enacted, that where the valuer shall certify to the commissioners that the value of the allotment of any person does not exceed £5, the party may (with his consent) be compensated in money. The valuer is also empowered to set out such private and occupation roads and ways, through the land to be inclosed, as he may deem requisite for the use, wholly or in part, of persons interested in other lands than those to be inclosed; the expense of setting out the same, as well as their maintenance after completion, to be defrayed by the respective owners, in such proportions as the valuer may direct, provided that the grass and herbage on such roads shall be subject to the same regulations as if they had been private or occupation roads set out under the original act. The expenses of maintaining the "private roads and ways, common ponds, ditches, watercourses, embankments, tunnels, and bridges," directed to be set out, enlarged, &c., are to be raised by a rate on the owners of the lands for the time being, for "such sum as the majority in value of owners, present at a meeting for the purpose, shall think requisite." A rating officer is to be appointed by a majority in value of the land-owners present on the first Monday in February in every year, by whom the salary shall be fixed—such officer to be removable by four-fifths in value of the land-owners present. In cases where persons shall, under the original act, mortgage their allotments for the purpose of raising money to defray the inclosure expenses, the money so raised is to be paid to the commissioners, who shall apply it accordingly, and whose receipt shall be a sufficient discharge to the mortgagee or lessee. Persons claiming any interest in an inclosure may prefer the same in writing to the valuer; such claims to state that common or other right or interest is claimed in respect of the land, premises, or right named in such claims; the places of abode of claimants or their agents to be also given. Persons trespassing where the rights of sheep-walk, common, or other rights are suspended or extinguished, or where the allotments have been made and entered upon, may be proceeded against, and, on conviction before two magistrates, be adjudged to pay compensation not exceeding £5, the money to be applied to the expenses of

he inclosure, or to the person in possession of the allotment, as the magistrates may think fit. Persons having taken possession of an llotment, may maintain any action of trespass, ejectment, &c., for lamage. If the owner of an allotment neglect to make any ditch r fence which, according to the directions of his award, ought to e made, the owner of any other allotment made in the same nclosure, who shall be prejudiced by his neglect, may serve the negligent party with a written notice (either personally or left at his place of abode) of his intention to do the necessary work, if not lone within three months; the expenses of the same to be recoverable by action of debt; and if the amount shall not exceed £20, it shall be recoverable in the County Court of the district where the work has been done. In case the owner of the allotment cannot be found, and the place of his abode be unknown, it shall be deemed good service to post the notice conspicuously on the allotment to which the same shall relate. With reference to exchanges of land, the thirteenth clause declares that it is expedient the provisions of the former act should extend to partition; and it accordingly enacts that, upon the application in writing to the commissioners, of parties interested in the several undivided parts of any land not to be inclosed under the Act of the 8th and 9th Victoria, or in land subject to be inclosed under such act as to which no proceedings for an inclosure shall be pending, and who shall desire to effect a partition of such land, the commissioners are empowered to direct inquiries whether such proposed partition would be beneficial to the owners of such undivided parts; and if in the affirmative, then (unless notice of dissent be given) an order of partition, with a map or plan annexed, specifying the land allotted in severalty, is to be framed and confirmed. It is also further enacted, that all the provisions of the original act applicable to such exchanges are to apply to partitions of land under this act. The last clause refers to common wood inclosure, and alludes to a provisional order made by the Inclosure Commissioners in 1846, relative to common wood in the parish of Holt, in Denbighshire, wherein it was declared that one twentieth part in value of the said common wood should be allotted to her Majesty, as lady of the manor of Bromfield and Yale, and that the same should be compensated by a money payment, and not by an allotment of land. The concluding notification is to the effect that this act is to be taken as part of the original act, and of the two subsequent acts to facilitate inclosures, and to extend the provisions of the former act.

The next act authorises the inclosure of certain lands in pursuance of the third, and also of a special report of the Inclosure Commissioners of England and Wales. These lands, as specified in the schedule annexed to the act, are situated in the following counties: — Berks: Burghfield; Bagley Wood. Buckingham: Great Missenden. Cambridge: Caldecot Open Fields; Benwick.

Chester: Antrobus; Mottram St Andrew. Carmarthen: The Grange Common. Cornwall: St Stephen's Down. Derby: Tansley Common. Devon: Ilton Moor; Cookbury Moor; Galsworthy Moor. Huntingdon: Upwood and Ramsay. Kent: Lyminge. Lincoln: Corringham and Springthorpe. Lancaster: Hesketh Marsh. Montgomery: Church Stoke and Hurdley. Montgomery and Salop: Hyssington. Oxford: Chinnor; Warborough. Salop: Oreton Common. Suffolk: Barrow; Woolpit; Hessett; East Green; Monksoham. Somerset: Dulverton; Isoa Common; Winsford; Stoke Pero. Surrey: Burstow; Shellwood Manor Waste. Sussex: Mid Lavant; Boxgrove; East Lavant. Southampton: Ellisfield Common. Stafford: Kingsley. Westmoreland: Asby Mask; Smardale Fell. York: Egton; Thornton Moor.

The third act also authorises the inclosure of certain lands, in pursuance of a special report of the Inclosure Commissioners for England and Wales. These lands are thus set forth in the schedule to the act, viz.:—Berks: Thatcham. Cumberland: Harras Moor. Devon: Ash Moor; Germans Week Common. Middlesex: Littleton. Oxford: Cottisford; Standlake, Brighthampton, and Hardwick. Radnor: Discoyed Hill. Suffolk: Drinkstone. Somerset: South Common. Southampton: Newton Valence; Greatham. Salop: Hodnet Heath. Wilts: Winterbourn Dantsey. Westmoreland: Newbiggin Moor. York: Kildwick; Hebden Moor; Warley.

Turnpike and other Roads.

There were four acts passed last session relative to turnpike and other roads; three of which are operative in Great Britain—the fourth, in Ireland. The first is entitled "An Act to continue certain Turnpike Acts for limited periods," and enacts, that every act now in force (except such as are specified in the subsequent clause) for regulating, making, amending, or repairing any turnpike road in Great Britain, which would have expired before the end of the next session of Parliament, shall be "continued" until the 1st of October 1849, and to the end of the then next session of Parliament. The excepted acts are five in number; all of which, save one, (leading from Ticehurst in Sussex to Hastings,) refer to turnpike roads in the immediate vicinity of London: these are to continue in force until the 1st of November 1849, "and no longer, unless Parliament shall in the meantime continue the said acts."

The second act refers to one passed in the 5th year of her present Majesty's reign, for authorising, for one year, an application of a portion of the highway rates to turnpike roads in certain cases. This act has been since continued from session to session;

and the object of the one passed on the 31st of August last is to "further continue it" until the 1st of October 1849, and to the end of the then next session of Parliament.

The third act—which received the royal assent on the 14th of August—is entitled "An Act to alter the mode of assessing the funds leviable in the county of Inverness, for making and maintaining certain roads and bridges, and other works in the Highlands of Scotland." The necessity for revising the mode of assessments has arisen from the great reduction that has taken place in the value of the kelp hitherto grown and manufactured upon the shores of certain estates in the above county, the annual value of which has always been included in the amount of the rents and profits of those estates as assessed to the property tax in 1814, at which period kelp bore a very high price in the market; but (as the act we are quoting expresses it) "since the passing of certain acts reducing and modifying the duty (which is now merely nominal) on the importation of barilla, kelp has so much fallen in value as to have ceased to be manufactured upon some estates, and on all estates has suffered a great reduction in price." The clause then proceeds to state, "it is just and expedient that such proprietors should pay assessments only upon the actual value of the produce of their estates, and that another and more equitable mode of assessment should be adopted." It is then enacted, that from and after the 15th of April 1849, the assessments to be levied in the county of Inverness, in virtue of certain acts (five in number) passed in the reigns of Geo. III., Geo. IV., and William IV., for "the maintenance and repair of the roads and bridges, and of the ferries, piers, and shipping quays, in the manner authorised by the said recited acts," shall be upon the annual value of lands and heritages as assessed to the property tax under the acts of 5th and 6th, and 8th and 9th of Victoria; and that in the event of the expiration or repeal of these two last acts, the assessments shall be made according to the annual values of the year immediately preceding such expiration or repeal. It is also further enacted, that if, at the end of five years after the expiration or repeal of the two last-mentioned acts, it shall appear to the commissioners of supply of the county of Inverness that the operation of the assessment under this act has become unjust or unequal, they shall be empowered to make a new rental "according to the respective annual values for the time of such lands and heritages; which new rental, when completed, shall, for the year of its completion and thereafter, be the rule of assessment under this act." The commissioners of supply are also invested with similar power, in the same circumstances, at the expiration of every *ten years*. The five statutes above alluded to, "except in so far as the same or any of them are or is altered by this act," are to remain in full force and operation, and to be applicable to the purposes of this act.

The last of the four acts refers to certain statutes passed in the 5th year of her present Majesty's reign, for "making, amending, and repairing the turnpike roads in Ireland," which statutes have been continued from time to time, (save as specially excepted,) and are, by the recent act, "further continued" until the 31st of July 1849, or, if Parliament be then sitting, until the end of the then session of Parliament. There is a proviso, however, to the effect that nothing contained in the new act shall apply to an act passed in the 38th of Geo. III., entitled "An Act to explain and reduce into one act the several laws for making, improving, and repairing the turnpike road leading from the city of Dublin to Killcullen bridge, in the county of Kildare, and to the twenty-one mile-stone westward of the said bridge, and for prolonging the duration of the act for repairing the road from Naas to Limerick, and for the further improvement of the road from Kilworth mountain to the city of Cork," except so far as the said act repeals any former act.

Drainage Acts.

Two acts relating to drainage were passed last session, one applicable to the United Kingdom, the other exclusively pertaining to Ireland. In reference to the former, it will be remembered that, in the parliamentary session of 1846, an act was passed to authorise the advance of public money for the improvement of land by drainage in Great Britain and Ireland; and in the subsequent session an act was passed to amend and explain the preceding one. By the provisions of these statutes, the Inclosure Commissioners were authorised, on approval of the lands to be drained, to grant a certificate for securing pecuniary advances. Doubts, however, have been entertained "whether, in cases where more than one certificate for an advance is issued in respect of the same provisional certificate, under the said acts, the specifications of the lands should not be repeated in full in every such certificate?" The short act passed last session removes these doubts, by simplifying the forms of certificates; and this is done by an enactment to the effect, that it shall not be necessary to do more in any second or subsequent certificate, than merely refer to the specification of lands contained in the first certificate. With regard to the power given to the Commissioners to cancel any certificate upon which no advance has been made, there is a provisional clause which declares that where a cancelled certificate shall have been registered in Scotland, the Commissioners are to deliver to the owner of the lands a memorandum of the cancellation, by whom it is to be registered. The concluding clause enacts that this act and the act of 1846 "shall be construed together as one act."

The other act is one "to provide additional funds for loans, for

drainage, and other works of public utility, in Ireland;" the preamble to which, after reciting the titles of numerous acts passed from time to time for providing the necessary funds for the prosecution of public works in the sister kingdom, proceeds to state, that in consequence of various presentments made at the Spring and Summer Assizes of the last and present year, in different counties in Ireland, several sums are made payable into the Exchequer in respect of advances under the authority of the recited acts; but inasmuch as certain of the works commenced remain unfinished, it is deemed expedient to provide further means of completing the same, and also of carrying on works of river drainage. With this view, the Commissioners of her Majesty's Treasury are, by the present act, authorised to issue a further sum "not exceeding £945,000," to the Commissioners of Public Works in Ireland; such sum to be issued from time to time, as may be required, during the term of three years, to be computed from the 5th of April 1848. Power is given to the Treasury, on application being made to them by the Grand Jury of any county, &c., to postpone the commencement of annuity payments chargeable on the baronies, districts, &c., of Ireland, in virtue of an act passed in the session of 1847–8 to facilitate the recovery of public moneys advanced for the relief of distress in that country. The annuities are to consist of an annual payment of £12 for ten years for every £100 chargeable as above, with interest up to the 1st of March 1848. Power is also given by this act to convert such annuities into others of longer or shorter duration, of equal value, not exceeding twenty years. In cases where the Grand Jury do not make application for conversion of annuities, the Clerk of the Peace may call a Special Sessions, at which Justices may make such application. Where occupation of rated premises is changed, the actual occupant of such property shall be the party liable.

The Game Laws.

Two acts were passed last session in connexion with these obnoxious laws, one applicable to England and Wales, the other exclusively to Scotland; the object of which is to relax their pecuniary severity as regard game certificates. The expediency of this measure, as stated in the preamble clauses, is based upon the notorious fact, that "much damage has been, and is, continually done by hares to the produce of inclosed lands, and that great losses have thereby accrued, and do accrue, to the occupiers of such lands," &c. It is then declared—

That from and after the passing of this act, it shall be lawful for any person, being in the actual occupation of any inclosed lands, or for any owner thereof, who has the right of killing game thereon, by himself, or by any person directed or authorised by him in writing, according to the form in the schedule to this act annexed, or to the

like effect; so to do, to take, kill, or destroy any hare then being in or upon any such inclosed lands, without the payment of any such duties of assessed taxes as aforesaid, and without the obtaining of an annual game certificate.

The "duties of assessed taxes" here adverted to, refers to two acts passed in the reign of Geo. III., and one in the reign of her present Majesty, where certain additional duties (among which was the game certificate tax) were granted and consolidated with the the assessed taxes. By the second clause, the authority to owners or occupiers of land to kill hares is limited to "one person at the same time in any one parish," which authority is to be sent to the Clerk of the Petty Sessions for registration, and to be held good until after the 1st of February in the year following that within which it is granted, unless the same be previously revoked; notice of such revocation to be given to the Clerk of the Magistrates. The third clause exonerates authorised persons from the game-keepers' tax; while the succeeding one extends to them permission to course or hunt. The fifth clause prohibits the laying of poison on any ground, whether open or inclosed, where game usually resort, or in any highway; and also interdicts the use of fire-arms of any description, by night, for the purpose of killing any game or hares. The sixth clause refers to agreements for the reservation of game, and enacts—

That where any tenant of any land for life or lives, years, or otherwise, now is, or hereafter shall be, bound by any agreement not to take, kill, or destroy any game upon any lands included in such agreement, then, and in all such cases, nothing herein contained shall extend, or be taken or construed to extend, to authorise or empower such tenant to take, kill, or destroy any hare upon any such lands so included in such agreement, or to authorise any other person to kill or destroy any hare upon any such lands.

The enactments in the second act, applicable to Scotland, are in all respects the same as those in the foregoing one, with the exception of the clause relative to agreements for the reservation of game, which is wholly omitted in the Scotch act.

Infected Sheep and other Animals.

It is a fact well known to the flockmaster and the grazier, that, during the past year, a contagious disorder broke out among sheep, cattle, and other animals, which entailed very serious losses upon the owners; but more especially did this attach to the former, which were found to be infected, to a very considerable extent, with a disease known as the "sheep pox," or "variola ovina." The impression that generally prevailed—and which there is no doubt was the fact—was, that this infection had been disseminated through the means of diseased stock imported from abroad. Hence the introduction of two bills—which received the royal assent on the 4th of September,—one to prohibit the importation of sheep, cattle, &c., the other to impose penalties upon those who should

expose for sale any stock suspected to be infected with any contagious disorder. By the first act, power is given to her Majesty to prohibit, by Order in Council, from time to time, as occasion may justify, the importation into the United Kingdom of "cattle, sheep, horses, or other animals, either generally, or from any place or places that may be named in such order." Regulations may also be issued for subjecting such stock to quarantine, or for causing the same to be destroyed upon their arrival in this country; and also for the destruction of any hay, straw, or fodder, by which infection may be conveyed. Any attempt to introduce foreign cattle contrary to the provisions of an Order in Council, will not only subject the same to be forfeited, but will render parties so offending liable to such penalties as are imposed for the violation of the customs' laws. Orders in Council—which may be revoked in whole or in part from time to time, as occasion may require—are to be twice published in the *London Gazette*, within fourteen days after the issuing of the same, and copies to be laid before both Houses of Parliament.

In the second, or companion act, it is enacted in the preamble clause, that any infected sheep or lambs exposed for sale at any fair or market may be seized by the clerk, inspector, or other appointed officer, who shall report such seizure to the mayor or magistrates, who may either restore them, or cause them, "together with any pens, hurdles, troughs, litter, hay, straw, or other articles likely to have been infected, to be forthwith destroyed, or otherwise disposed of." A penalty of £20 is incurred for every offence of exposing such cattle, sheep, &c., for sale, knowing them to be diseased. A similar penalty is incurred for depasturing diseased sheep, &c., "upon any forest, chase, wood, moor, marsh, heath, common, waste land, open field, road side, or other undivided or uninclosed land;" and a similar penalty for exposing for sale meat unfit for human food. The fourth clause enacts that the Lords of the Privy Council may make regulations as to the removal of sheep, &c., to prevent the propagation of infection; and also for the purpose of purifying yards, stables, &c., waggons, or other vehicles; and also for the disposal of animals dying in an infected state; and also for the purpose of causing notices to be given of the appearance of disease among sheep, cattle, &c.; all persons offending against such regulations to be liable to a penalty of £20 for every offence. All such orders and regulations to be published within fourteen days after the issuing of the same twice in the *London Gazette*, and twice in some country newspaper circulating where the notices apply. The penalty for obstructing persons in the execution of this act to be £5, or two months' imprisonment. Penalties (which are to be sued for within two months after the commission of an offence) to be recovered by distress on offender's goods; in default of distress, imprisonment for three months. One half the penalties to be given to

the party suing for the same, and one half to the Queen. Parties feeling themselves aggrieved may appeal to the Quarter Sessions on giving security. The 19th clause enacts that where a suit shall be brought on account of the seizure of any sheep, cattle, &c., and of any meat supposed to be unfit for human food, which, upon inquiry, shall be afterwards restored, and the judge shall certify that there was "a probable cause of seizure," the plaintiff is not to be entitled to more than twopence damages, and the defendant to be fined one shilling only. The act—which is not to affect the corporation of London in its rights and privileges in matters herein referred to—is to continue in force for two years, namely, from the 1st of September 1848 to the 1st of September 1850.

Distillation from Grain, &c.

An act received the royal assent on the 4th of September, which repeals an act passed in the previous session "to further encourage the distillation of spirits from sugar;" and also repeals parts of two other acts, passed in the reign of George IV., relative to the excise duties upon spirits distilled from corn or grain in Scotland and Ireland, and permitting the distillation of spirits from sugar, molasses, and treacle in the United Kingdom, under certain regulations specified in subsequent clauses. The act then proceeds to state, that licensed distillers may distil from sugar only, or from potatoes only, or from molasses only, or from treacle, or from any of these materials and "malt or grain mixed." We give the fourth clause entire, that being the only one of interest to the corn-grower—all the rest being merely practical enactments for the information and guidance of the distiller, and fiscal provisions for the better securing of the revenue. The clause alluded to runs thus:—

> And be it enacted that, except as provided by this act, and by an act of the second and third years of the reign of his late Majesty King William IV., entitled "An act to permit the distillation of spirits from mangold-wurzel," it shall not be lawful for any licensed distiller in England, Scotland, or Ireland, to make or brew any worts or wash, or to distil any spirits, from any other materials whatsoever than malt, corn, or grain, or some mixture thereof; and if any licensed distiller in England, Scotland, or Ireland makes or brews any worts or wash, or distils any spirits, otherwise than as aforesaid, he shall incur the penalty of two hundred pounds, and all such materials, worts, wash, and spirits, shall be forfeited.

Tithe-Rent-Charge.

The act passed on the 31st of August last, in reference to tithe-rent-charge, is intended to operate in connexion with a statute passed in the 1st and 2d of her present Majesty, for the more effectual relief of the destitute poor of Ireland by the contribution of payments on all rateable property. By the new act, (containing three clauses,) lessees of tithe-rent-charge (if liable to pay rent for

the same) are empowered to deduct a proportion of poor-rate poundage from such rent; or, as it is expressed in the act, "where any person entitled to receive tithe-rent charge shall be liable to pay a rent in respect of the same, he shall be entitled to deduct from the rent so paid by him a sum bearing such a proportion to one-half the amount of rate, deducted from the tithe-rent charge received by him, as the rent paid by him in respect of such tithe-rent charge bears to the tithe-rent charge which he is entitled to receive."

The second clause refers to an act passed in the reign of William IV. for "altering and amending the laws relating to the temporalities of the church in Ireland." Doubts having arisen as to the authority of the commissioners under that act, relative to the allowance of deductions, it is by the above clause more clearly defined, namely—that the Ecclesiastical Commissioners in Ireland are empowered to allow sums paid for poor-rate or county cess, or poundage deducted from ecclesiastical persons on account of poor-rate, in the deductions from the valuation of ecclesiastical property.

The third clause declares, that all after-successors of the present Archbishops of Armagh, and the present Bishop of Derry, shall be entitled to deduct from the sums to be paid by them to the Ecclesiastical Commissioners for Ireland "such amount or sum as the commissioners shall ascertain as proper to be deducted for or on account of any poor-rate or poundage-rate for the relief or employment of the poor, or for repaying any advances made for these purposes, and paid, or payable, or deducted in respect of ecclesiastical property, by the tenants of such see, such deduction to bear the same proportion to the entire poundage for poor-rate allowed in such half-year to his tenants by such archbishop or bishop, as the said half-yearly annuity bears to the rent and fines received by such archbishop or bishop in such half-year."

Improvement of Irish Agriculture—The Irish Encumbered Estates Act.

Of the measures passed for the benefit of Ireland, during the last session, perhaps none are more to be appreciated than those which have for their express object the improvement of the agriculture of that country. Of this character were two; one proposing to offer greater facilities for *the sale* of land in Ireland; the other, to facilitate *the purchase* of land in that country. The former is entitled the Irish Encumbered Estates Act; the latter, the Farmers' Estate Society Act. In reference to the first, it will be remembered that special allusion was made to it in the prorogation speech, by the expression of her Majesty's hope that

"it would gradually remove an evil of great magnitude in the social state of Ireland."

As this act contains no less than seventy-five clauses, it may suffice that we merely recite the substance of the leading provisions, which are these:—

Where any land in Ireland is subject to incumbrance, the owner may, subject to the approbation of the Irish Court of Chancery, contract to sell the same, freed from all incumbrances; and any person, being the first incumbrancer, or any person being an incumbrancer in possession of the title-deeds relating to such land, may also (without having so contracted) apply to the Court for permission to sell such land. Lands are not to be deemed subject to incumbrance except the same affect a term of not less than fifty years' unexpired, nor unless such incumbrance shall have been created by the owner of an estate of inheritance. Where leases in perpetuity, of land for a term of which not less than sixty years are unexpired, are subject to incumbrance, the owner of such leases may, subject to the approbation of the Court, sell the same. Leases in perpetuity, however, are not to be subject to an incumbrance, where the same shall affect a derivative estate or interest only, or less than the whole estate created by such lease in perpetuity; but any incumbrance charged under a power created by the owner of a whole estate, shall be considered as an incumbrance created by the owner. In all cases where a contract for the sale of land is concluded, application (by summary petition) is to be made to the Lord Chancellor of Ireland to confirm the same; such petition to set forth the nature of the various incumbrances with which the land is charged. Upon the presentation of a petition, the Court may refer the same to a Master in Chancery, who shall inquire into the particulars, and report accordingly—notice to be previously given to all persons interested in the subject of such inquiry. Persons feeling aggrieved by the report of the master are not compelled to take exceptions to the same. In case of death, or transmission, or charge of interest, parties may apply to the Court to carry on proceedings. Persons claiming an interest in any land or lease in Ireland may enter a caveat in the Registrar's office, and be thereby entitled to receive notice of any subsequent proceedings in reference to the same; all the directions of this Act, as to proceedings, are to have the force and effect of orders of the Court. When an incumbrance is subject to limitations of estate or interest, or shall be held upon any trust, "the first person entitled to the income of such incumbrance, or the trustee, or other person whom the Court may think fit, shall be the person to make any application or give any consent under this act in respect of such incumbrance." By a subsequent clause it is enacted, that where it shall appear there is more than one incumbrance, the Court may direct

proceedings to be instituted to ascertain priority. Where any person is entitled to any charge, not being an incumbrance within the meaning of this act, and is willing to accept a gross sum in satisfaction of such charge, the master may treat the same as an incumbrance; and where any land or lease, a part only of which shall be desired to be sold, the master shall be at liberty to charge the remaining portion of the estate in exoneration of the land or lease disposed of. Any order for sale to be made by the Court may include the whole or any part of the incumbered land or lease, and may provide that any part intended to be sold shall remain subject to any incumbrance which the Court shall think fit; and where the master shall have approved of the sale of a part only, it shall be in the discretion of the Court to order the whole of an estate to be sold. The purchase-money arising on sales to be paid into the Bank of Ireland, or invested in the funds, and in no case to be liable to usher's poundage. The owner of land or lease in perpetuity, subject to incumbrances, may sell, without the order of the Court, unless restrained after the publication of notices. Where any land or lease is proposed to be sold without the order of the Court, notice of such intention must be served personally on all persons having estates in remainder or other future estates in such land. No notice of an intention to sell any land or lease shall be permitted to prejudice or affect the right of any mortgagee, or other incumbrancer; nor is any land or lease proposed to be sold without the order of the Court, to be sold below the fair selling value thereof, the same to be certified by a surveyor appointed by the Lord-Lieutenant. Where required by the party entering a caveat, the owner or incumbrancer must give notice of the price at which the land or lease is contracted to be sold. Where the principal money owing on an incumbrance shall be actually payable, or where the interest thereon shall be in arrear for twelve months or upwards, and the owner neglects to discharge the same after six months' notice from the incumbrancer, the latter may, without the order of the Court, sell such land or lease, or any part thereof, and pay the proceeds into the Bank of Ireland: no such power to sell, however, is to be given to the incumbrancer, "unless the principal sum of £200, at the least, shall be owing on his incumbrance." In cases where several incumbrancers give notice to the owner for payment of money due, the first of such incumbrancers may sell. All notices from an incumbrancer to be given in writing to the owner, or left at his place of abode. After the expiration of five years from the time of the payment of purchase-money into the Bank of Ireland, arising from the sale of land, &c., without the order of the Court, the conveyance to have the same operation as if the sale and conveyance had been made under the order of the Court; all rights, as regards sales made without the order of the Court, are not to be affected, if prosecuted by the parties interested within five years.

No payment towards the discharge of any incumbrance, not being payment in full, shall affect the right of the incumbrancer to recover the balance; nor is any payment in respect of any incumbrance to impair the right of any persons out of whose estates the same shall be made. If any land or lease is sold, subject to a lease or under-lease for years or lives, comprising other land at an entire rent, the master may apportion the rent between the land or lease to be sold and the remainder of the land subject to such rent, on giving previous notice thereof. No person entitled to any incumbrance shall be bound to accept payment without six months' notice; "but when such notice shall have been given, no fresh notice shall be necessary if the money shall be paid within three months after the day fixed." The Court may appoint guardians of infants to act for them for the purposes of this act, as well as persons to act on behalf of lunatics. No petition for sale by order of the Court can be authorised unless with the consent of the incumbrancer in possession, nor pending any suits which may have been commenced before the first of July 1848. No petition for executing a contract for sale presented by assignees of bankrupts or insolvents to be entertained by the Court without the consent, previously obtained, of the major part, in number and value, of the creditors assembled at a meeting convened for that purpose. The seventy-second clause is intended to remove certain doubts, which, it seems, are entertained, as to whether, when a judgment affects lands in Ireland, and when the person entitled to such judgment is willing to release a portion of such lands in order to the sale thereof, or otherwise, he can grant such release without nullifying the effect or validity of such judgment upon the residue of such lands. Upon this point the clause in question enacts affirmatively. Annual returns are to be laid before Parliament, showing the total quantity, in statute acres, of all lands sold under the provisions of this act during the year ending the 31st of December then last past, together with a statement of the total annual rent of such lands, (so far as the same shall have been shown in the proceedings;) the total amount of incumbrances which affected such lands at the time of the applications for the sale thereof respectively under this act; the total amount of purchase-money for the same, together with the total amount of all such law-costs incurred as shall have been paid out of such purchase-money; and of all other charges and expenses which may have been paid or deducted from the proceeds of such sales under the order of the Court. The concluding clause limits the operation of the act, "except so far as the special provisions of the same require," to Ireland only.*

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* An attempt was made, during the progress of the bill, by Sir Lucius O'Brien, to extend its operation to England and Scotland, but it was successfully opposed.

Farmers' Estate Society Act.

This, though a local statute, may be considered a companion act to the foregoing, the object of its provisions being, as already stated, to promote the *purchase* of land—a measure based on the principle of promoting the better cultivation of land in the sister kingdom, the reclamation of waste land, and, as stated in the preamble, of "personally interesting a large proportion of the population in the preservation of peace and order."

His excellency, the viceroy, having had his attention officially called to the subject, delivered it as his opinion—the result of assiduous investigation—that there were a number of persons in Ireland possessing a limited amount of capital, which they would gladly employ in the purchase of land, if facilities were given for the transfer of estates or portions thereof. These objects are proposed to be effected by means of the formation of a permanent body of independent yeomen, (to be incorporated as a Joint-Stock Company,) consisting of resident proprietors, holding farms in fee simple, containing respectively not less than thirty acres. Another important object sought to be attained by this act is, its counteracting tendency to that minute subdivision of land which has constantly afflicted Ireland with so large a population of pauper cottiers. Any individual, it is well known, may purchase land and afterwards sell it in any quantity he chooses; he may buy, for instance, a hundred acres, and sell them again to two hundred individuals, in half-acre patches. By this act, certain parties named, (of which the Earls of Devon and Courtown stand at the head,) as well as "all other persons who have already subscribed, or shall hereafter subscribe to the capital of the said undertaking, their executors, assigns," &c., shall be constituted a body corporate, by the name of the "Farmers' Estate Society of Ireland," the operations of which (extending to lands in Ireland only) to be limited to twenty-one years.

The capital of the company is to consist of £250,000, divided into 12,500 shares of £20 each; £5 per share, to be the greatest amount of the first call demanded, and £2 per share, to be the greatest amount of any subsequent call, and six months at least to intervene between successive calls. The ordinary meetings of the company are to be held in Dublin half-yearly, in the months of January and July, the first of which to be held in the month of January 1849. The preliminary meeting was held in October last. The number of directors at the commencement is to be seven, which may be increased or reduced by the company, but in no case to exceed twelve, or to be less than five. The ownership of fifty acres to confer a qualification for director. The Earl of Courtown and six other shareholders are named in the

act as the first directors of the company. The thirteenth clause invests the company with power to purchase lands, and to sell and alien the same; but with the proviso that no shareholder, while filling the office of director, shall be permitted to traffic in any lands purchased by the company. In reference to the proceedings as to the sale of lands, it is enacted that no lot, authorised to be sold, shall be disposed of in any case, or that more than one person shall be the owner of thirty acres. The sixteenth clause makes the following provision for cottage allotments for farm-labourers:—

That for the purpose of providing residences and suitable accommodation for farm servants and labourers on such estates purchased by the company as from their size would, if required to be laid out wholly as aforesaid, cause great inconvenience to the labouring population of the district, it shall be lawful for the company to reserve and set apart out of every property purchased by them which shall contain more than 1000 acres in one lot, an allotment of half an acre for each 1000 acres, for the erection of a village or collection of labourers' houses, to be in the proportion of one such allotment for a cottage or house, to every thirty acres: each person purchasing land from the company out of the said estate, to have a prior claim to purchase one such cottage allotment in addition to every thirty acres purchased.

Tenants, in the occupation of land purchased by the company, and who may be evicted for the purpose of carrying this act into execution, to be entitled to compensation. The company is to be allowed to fix the time and mode of payment of the purchase-money of the several farms or lots of land to be sold; but no agreement or contract is to admit of a longer period than ten years for the payment in full of the purchase-money. In case of non-payment of one or more of the instalments, the same proceedings for the recovery of arrears may be employed as for non-payment of rent. All lands purchased by the company and remaining undisposed of at the end of seven years, are to be sold, either together or in lots, by auction or by private contract. To prevent the division of lands sold under this act into lots of less than thirty acres each, it is enacted that in case any piece of land sold by the company shall, by contract, conveyance, &c., become divided, the same shall be charged with one-half the poor-rate valuation, to be payable by the occupier to the poor-law guardians; the occupier, if a tenant or lessee, to deduct the amount of charge from his rent. The thirty-third clause enacts, "that the powers in this act contained, relating to the purchasing and holding of land by the company, shall not be exercised or put in force until a certificate, under the hands of two justices, shall have been obtained, in the manner provided by the Lands Clauses Consolidation Act of 1845, certifying that one-half of the capital of the company for the time being has been subscribed for, and that at least £10 per cent, in amount thereof, has been paid up." Interest not exceeding 4 per cent to be allowed on calls paid up, for any period the Directors may think proper, "not exceeding five years." Any lands

held under lease, a part only of which has been purchased by the company, are to have the rent, or renewal fines, &c., apportioned accordingly. No lands to be purchaseable by the company without the consent of the owner, or under the authority of a Chancery or Exchequer decree. The company to be restricted to the possession, at any one time, of not more than 30,000 acres of land. The concluding clauses merely refer to the saving rights of the crown and of the Commissioners of Public Works. Three schedules are appended to the act containing the prescribed forms of conveyance; viz., the form to the company; the form by the company, when the whole of the purchase-money is to be paid at the time of the execution of the conveyance; and the form by the company when the purchase-money is payable by instalments.

Transfer of Landed Property in Ireland.

The object of this measure, which, like the two preceding, is hailed as a great boon to Ireland, is to guard against contingencies, of which parties were sometimes not aware, in purchasing land in the sister kingdom. By the previously-existing law, serious inconveniences attended the searches in the registrars' offices; not the least of which was the expense to which parties were put in obtaining information essential to the prosecution of their transactions. By the new law, which is entitled "An Act to facilitate the transfer of landed property in Ireland," it is proposed to obviate much of what was hitherto objectionable, by rendering greater facilities to parties in the diminished expense of registry researches, and other matters, as will be found disclosed in the subjoined analysis of the respective clauses; thus making one great legislative advancement towards that entire reform in the registration system of Ireland, which several members of the Upper House expressed their hope it was the intention of the government to ultimately carry out.

The first, or preamble clause, enacts, that from the passing of the act, (Sept. 4,) the Registrar of Deeds and the Registrar of Judgments in Ireland shall, previous to giving out any negative search, cause a copy of the same, entered on parchment, to be recorded in their respective offices. Books containing such copies to be provided with indices, (to be altered as occasion may require by the Treasury,) and to be open to public inspection on payment of tne fee of one shilling in each office. Attested copies of recorded searches are to be furnished by the respective registrars, on payment of the fee notified in the schedule annexed to the act—namely, for every attested copy of a search, in either office, not exceeding three folios of seventy-two words, one shilling; and for every folio exceeding three, fourpence; such attested copies to be deemed equivalent to a new search to the same extent; and for every other

certificate required by this act, including a duplicate thereof, one shilling. The Registrar of Judgments, upon the production of a certificate of the entry of satisfaction upon the roll of any judgment of any of the superior courts of common law, is to enter a memorandum of the same upon the entry of registry. Every court by whom a decree has been pronounced, must also direct its officer to give a certificate thereof, and record the same in his office; and should the decree have been registered under the provisions of either of two former acts, (viz., 3d and 4th Vic. cap. 105, or 7th and 8th Vic. cap. 90,) a memorandum is to be annexed to the entry of registry; but no judgment, crown bond, or recognisance decree, &c., is to be registered until a certificate of the existence of such judgment, &c., has been lodged with the registrar. The fees to be paid for a memorandum of satisfaction of a judgment, crown bond, &c., is two shillings and sixpence. From the 1st of January 1849, crown bonds and recognisances, more than twenty years old, are not to affect purchasers or mortgagees, unless re-docketed in the office of Registrar of Judgments. The concluding clause of the act authorises the Treasury to consolidate, with a view to economy, certain offices, the duties of which may, by the operation of this act, be diminished; and to provide for the discharge of such duties as remain to be performed.

Markets and Fairs.

Four acts were passed last session relative to Agricultural Markets and Fairs: two referable to the county of Salop; one to the principality; and the other to Ireland generally.

Shrewsbury Cattle-Market Act.—According to the preamble of this act, the providing a market-place, for the sale of cattle and other animals, in the borough of Shrewsbury, would be "of great public advantage," and that "certain persons named in the act are willing to carry such undertaking into effect;" these persons being the mayor, aldermen, and burgesses of Shrewsbury, to whom power is given by this act to borrow money on mortgage, to the extent of £15,000, to enable them to carry out their intentions. The lands to be appropriated by the corporation for extraordinary purposes are to be restricted to ten acres. Various minor clauses are introduced for the due execution and maintenance of the proposed market, (which is to be completed within five years from the passing of the act—June 9, 1848,) and also for the levying and collecting of tolls for the cattle-market and for slaughter-houses; the rates of which are specified in a schedule annexed to the act. Another schedule also describes the property, (and to whom belonging,) intended to be removed for obtaining the proposed site. It is notified that the Lands Clauses Consolidation Act of 1845, and the Mar-

kets and Fairs Clauses Act of 1847, (with the exception of that portion of the last-mentioned act which has reference to the weighing of goods and carts,) are to be incorporated with and form part of this act.

Oswestry Markets and Fairs Act.—The expediency of this act—passed on the 30th of June—is based on the fact, that the markets and fairs in the borough of Oswestry have long been held in the streets and other principal public thoroughfares in the town, whereby the same are rendered dangerous and inconvenient to the public: it is consequently considered that much public and local advantage would ensue if the said markets and fairs were removed, and proper and more suitable accommodation provided within the town. The operative clauses then proceed to enact, that the execution of the act be confided to the Corporation of the borough of Oswestry, who are empowered to borrow, on mortgage of the lands, buildings, &c., acquired by them for the purposes of the markets and fairs, a sum not exceeding £5000. The twenty-first clause refers to the proposed sites for the erection of the new markets, as follows:—

And whereas a piece of ground situate on the north side of the Cross, in the said town and borough, between the Cross and a certain passage called the Clawdd-dû, and also a certain other piece of ground situate on the north side of the said passage, and containing in the whole 798 superficial yards or thereabouts, is advantageously situate for the site of a market, and a commodious structure hath already, and at considerable expense, been erected thereon, and the same is well adapted for the purpose of a market-house and covered market, but the same hath not hitherto been completed; and whereas the present Town-Hall, situate on the Bailey Head, with several small dwelling-houses, buildings, and land connected therewith, or nearly adjoining thereto, (of which the Earl of Powis claims to be owner,) is advantageously situate for the site of a corn, meat, and wholesale butter and cheese market; be it therefore enacted, that it shall be lawful for the Council to purchase the same, or any other lands or buildings requisite for the purposes of this act. [A description of the property here referred to is given in a schedule.]

The lands to be appropriated by the Council for extraordinary purposes are not to exceed four acres; and the proposed market-places and places for fairs are to be completed within five years from the date of this act. A series of the usual clauses, as in the preceding act, authorise the taking of tolls, the rates of which are specified in two schedules appended to the act. There is a notification that the Lands Clauses Consolidation Act of 1845, and the Markets and Fairs Clauses Act of 1847, are to be incorporated with and form part of this act.

Aberavon Market Act.—The borough of Avon, otherwise Aberavon, in the county of Glamorgan, is another of those towns in which an established market-place, or place for holding fairs for the sale of live stock, provisions, and agricultural produce, has long been much needed; the periodical assemblings for these necessary purposes having been hitherto confined to the streets and thorough-

fares of the borough, to the great inconvenience of business transactions, and the personal insecurity of the community. A recent act of liberality on the part of the Earl of Jersey, by the free gift of an appropriate site (together with certain lands and tenements) for the erection of a commodious market-place, will supply this desideratum: hence the present act—passed on the 14th of August last—for giving legislative effect to his lordship's munificence, by empowering the municipal authorities to take possession of the said lands, &c., with a view to the construction of a market-place and place for a fair, with all necessary buildings and works for the sale of such commodities as are commonly sold at markets and fairs, and which are specified in a schedule annexed to the act. The undertakers (*i. e.*, the portreeve, aldermen, and burgesses of the burgh) are empowered to borrow, on mortgage of the works, stallages, rents, &c., any sum not exceeding £3000. Lands taken for extraordinary purposes are not to exceed three acres. Seven years from the passing of the act to be allowed for completing the undertaking; after which no market or fair business will be permitted in any of the public places heretofore so appropriated, under a penalty of 40s. for every offence. Several consecutive clauses authorise the demanding of stallage, rents, tolls, &c., and direct the mode of applying the same. By the 15th clause, any money in the Court of Chancery in which the corporation of the borough claims an interest, may be rendered available to the purposes of this act to the extent of £3000, on petition to the Court from the municipal body. Five schedules are appended to the act; the first describing the lands, &c., constituting the gift of the Earl of Jersey; the others setting forth the amount of tolls, rents, and stallage leviable on the completion of the new market. The Lands Clauses Consolidation Act of 1845, the Markets and Fairs Clauses Act of 1847, and the Commissioners Clauses Act of 1847, are, by distinct enactments, declared to be incorporated with this act.

Corn Markets, &c., of Ireland.—In the early part of the reign of George III., an act of the Irish Parliament was passed for punishing such persons as by violence obstructed the freedom of corn markets and the corn trade of that country, and for awarding compensation to the parties injured. During the last session, an act was passed (August 31) "repealing" so much of the former statute as relates to the awarding of compensation, and substituting other provisions in lieu thereof; and "repealing," also, the provisions contained in certain relative acts passed in the reigns of Edward I., Edward III., and Charles I., which gave remedies against any hundreds or baronies in Ireland in respect of robbery. The following is a specimen of the offences alluded to in this act, as constituting the "obstructions" to the freedom of corn markets and the corn trade:

Mischievously or wantonly setting fire to any house, outhouse, or other building, or any haggard, corn, hay, straw, or turf; or the maliciously setting fire to, or sinking any boat or barge laden with corn or other provisions; or the maliciously killing, maiming, houghing, or injuring any horse, mule, ass, or swine, or any horned cattle or sheep; or the maliciously damaging or destroying any bank, gate, lock, weir, sluice, bridge, dam, or other work belonging to any person, public canal, or navigation, &c.

The expediency of the measure, passed in August last, was founded on the great expenses hitherto incurred in proceeding by action at law under the act of George III. By the new law, shorter, less expensive, and more summary proceedings in recovering damages may be resorted to. For example, any damages sustained by means of any of the offences recited in the former act, may in future be recovered in the same manner as damages are recovered under the 6th and 7th William IV., and the 7th and 8th of her present Majesty. Compensation for offences committed in the city of Dublin may also be recovered under the provisions of the 4th and 5th of Victoria. Any actions commenced before the passing of the act of last session for recovery of damages under the old acts (now repealed) may be discontinued, and such damages may be recovered by the presentment of a grand jury; and in cases where remedies are sought against hundreds or baronies, it is expressly provided that the damages "shall be levied off the barony, county of a city, or county of a town, in which such robbery shall have been committed."

Petitions.

The following petitions on matters kindred to agriculture were presented to Parliament during the last session:—

Agricultural Tenant Right—In favour of, 1 petition; 60 signatures.

Agricultural Schools—For the establishment of, 1 petition; 1 signature.

Breweries and Distilleries—Against the use of grain in breweries and distilleries, 1 petition; 120 signatures. [In the previous session there were 59 presented, with 17,521 signatures.]

Corn Laws—For the repeal of, 1 petition; 35 signatures. Against the resumption of the Corn Laws, (1846,) 2 petitions; 2 signatures.

Cattle, Sheep, &c.—Respecting depredations, by killing, &c., 5 petitions; 71 signatures.

Commons and Waste Lands (Ireland)—For inclosure of, 11 petitions; 3154 signatures.

Game Laws—For repeal of, 45 petitions; 7360 signatures. [In the previous session there were but 4 petitions, with 4 signatures.]

Highways—For alteration of the law of, 3 petitions; 16 signatures. *Against* the Highways Bill, 4 petitions; 2374 signatures. *For* alteration of, 3 petitions; 3 signatures. *For* consideration of, 1 petition; 34 signatures.

Land Tax—For equalising it, 3 petitions; 3 signatures.

Lands Clauses Consolidation Act, (1845)—For amendment of, 1 petition; 1 signature.

Landlord and Tenant (Ireland) Bill—*For* alteration of law, 55 petitions; 30,636 signatures. *Against* alteration, 50 petitions; 38,322 signatures.

Malt Tax—For its repeal, 3 petitions; 105 signatures. For an alteration of the law, 5 petitions; 84 signatures.

National Land Company—For alteration of law, 2 petitions; 155 signatures.

Remedies against the Hundred—For alteration of law, 2 petitions; 155 signatures.

Turnpike Trusts—For consideration of, 30 petitions; 1540 signatures.

RATIONALE OF THE APPLICATION OF SPECIAL MANURES.

By Mr Thomas Rowlandson, Liverpool.

Connected with the application of special manures, an important question arises, whether they can be profitably applied at once, so as to meet the wants of an entire rotation of crops, in a manner analogous to that ordinarily pursued when the farmer uses farm-yard manure, viz.—by the application of a large amount of manure to the first crop of the course, usually potatoes or turnips? Two objections arise to the application of the whole of the manure, whether special or otherwise, to the first crop of a series, viz., an unnecessary expenditure of capital at the earliest stage, and the loss arising from a large amount of manure being wasted during the intervals occurring between each crop; but, more particularly, from the waste which takes place by a considerable part of the manure being carried off, whilst vegetation is in a dormant state, by the rains of winter. When a farmer applies 20 tons of farm-yard manure to either turnips or potatoes, containing, on an average, 156 lbs. of potash and phosphoric acid respectively, it must be borne in mind that a large portion of both these substances are not in a free state, but only slowly become so by the gradually decomposing effects of rain and the atmosphere. There are also strong grounds for believing that the carbonaceous substances formed by the complete decomposition of farm-yard manure possess properties analogous to charcoal, viz.—the power of retaining several volumes of various gases, and also a considerable amount of salts. These causes united, tend to render the waste which would otherwise occur, much less than might be anticipated: the alkaline salts being the most soluble, and consequently most obnoxious to waste, are fortunately those salts which are appropriated in the highest degree by green crops. Seeing that there are no great practical disadvantages arising from applying the whole amount of the farm-yard manure adapted for a rotation, to the green or first crop of the series, whilst there are several advantages in doing so, we cannot be surprised that such a system is usually adopted, possessing as it does so many practical and theoretical conveniences: the practical advantages of which are—that the farmer gets a laborious task performed at once; its susceptibility of being more evenly spread in consequence of its great bulk; the more decayed portion

of the manure becomes the first food of the crop, whilst the less rotten part is slowly decomposing, thus becoming gradually available; and lastly, the green crop is one on which a large amount of labour is expended, greatly more proportioned than what is required by the succeeding crops. So necessary is this labour in the items of ploughings, harrowings, hoeings, weeding, &c., that were they not adequately performed, the crop would be of little value; and this remark applies in degree to all crops. In order to meet this extraordinary expenditure in the items named, it is necessary that the crop should be a good one; and this, it is well known from practice, cannot be obtained without a considerable expenditure of farm-yard manure,* which brings me to the consideration of the theoretical† advantage obtained by a great outlay of manure on the green crop. If the hypothetical quantity of farm-yard manure adapted for a rotation of four shifts is assumed at 20 tons, and this quantity is divided into four parts, or five tons each, it would follow that only 40 lbs. of potash would be applied to the green crop, whilst it would require from 120 lbs. to 150 lbs., according to the description of crop. This will be better understood by inspecting the following tables, giving the amount of the inorganic constituents of two four-course shifts:—

First Example.

	1st Year.	2d Year.	3d Year.	4th Year.	TOTAL.
	Potatoes.	Wheat.	Clover.	Wheat.	
Potash,	150	23‡	46½	23	242½
Soda,	12	1½	5	1½	20
Lime,	9	8	111	8	136
Magnesia,	20	6	35	6	67
Sulphuric acid,	60	—	13	—	73
Phosphoric acid,	33	20	20	20	93
Chloride of sodium,	—	—	8	—	8
Chloride of potassium,	—	—	8	—	8
Chlorine,	18	—	—	—	18
Silica,	—	84	10½	84	178½

* In all calculations affecting the farm, it must be borne in mind that the important items of rent and taxes remain the same whether the crop is a bad one or a good one.

† I have used the term theoretical advantage in deference to current opinions: my own conception is, that the advantages here assigned *are established by facts*, and consequently, instead of being theoretical, should be stated amongst the practical advantages of the course here pointed out.

‡ Messrs Way and Ogston have published some experiments in the ninth volume of the *Journal of the Royal Agricultural Society of England*, which were made for the purpose of ascertaining whether any inaccuracy existed in their prior determinations of the inorganic constituents of plants,—several of which I quoted in my last paper. This second series has been made in consequence of its having been asserted in an American scientific journal that a loss took place, particularly in the alkaline bases, in the process of burning the plants for analysis: it is satisfactory to learn that the only error of any consequence has arisen in the determination of sulphur. This may prove an interesting matter for chemists, but has little or no economic value for the farmer, as he has an extensive and cheap source of sulphur in gypsum.

Second Example.

	1st year. Turnips.	2d Year. Barley.*	3d Year. Clover.	4th Year. Wheat.	Total.
	lbs.	lbs.	lbs.	lbs.	lbs.
Potash	140	23	46½	23	232½
Soda	33	1½	5	1½	41
Lime	90	8	111	8	217
Magnesia	14	6	35	6	61
Sulphuric acid . . .	50	...	13	...	63
Phosphoric acid . . .	45	20	20	20	105
Chloride of sodium . .	57	...	8	...	65
Silica	...	84	10½	84	178½
Chloride of potassium .	...	...	8	...	8

The preceding tables show that the first rotation, commencing with potatoes, requires 242½ lbs. of potash and 93 lbs. of phosphoric

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Amongst other valuable analyses given are those for clover and rye-grass. In the above tables I have estimated 2 tons of hay to the clover crop, namely, 1¼ tons to 1½ tons as hay, the remainder consumed in eddish or fogs—in which form I calculate an amount of mineral matter equal to half a ton will be carried away by grazing cattle or sheep, particularly if grazed by milk-cows.

Mineral Matter in a Ton of Red and White Clover Hay.

	Red Clover.	White Clover.
	lb.	lb.
Silica, ...	5·2	6·3
Phosphoric acid, ...	10·0	19·9
Sulphuric acid, ...	6·6	12·4
Lime, ...	55·6	45·5
Magnesia, ...	17·7	14·0
Peroxide of iron, ...	1·5	3·4
Potash, ...	23·2	24·7
Soda, ...	2·2	6·4
Chloride of Sodium, ...	3·7	8·5
Chloride of potassium, . . .	4·7	—
Total, . . .	128·4	141·1

Analyses of the Ash of Italian Rye Grass cut when in Flower and Seed.

	Percentage of the Ash.		In a Ton of the Specimens.	
	In Flower.	In Seed.	In Flower.	In Seed.
Silica, ...	59·18	60·62	81·7	75·5
Phosphoric acid, .	6·34	6·32	8·8	7·8
Sulphuric acid, .	2·82	1·31	3·9	1·6
Lime, ...	9·95	12·29	13·8	15·3
Magnesia, . . .	2·23	2·64	3·1	3·3
Peroxide of iron, .	0·78	0·30	1·1	0·4
Potash, . . .	12·45	10·77	17·2	13·4
Soda, ...	3·98	0·13	5·5	0·2
Chloride of Sodium, .	2·27	5·58	3·1	6·9
	100·00	99·96	138·2	124·4

* Not possessing an accurate account of the entire mineral constituents of a barley crop, I have substituted in the barley column the mineral ingredients of wheat as

acid; by the second table of rotation, commencing with turnips, 232½ lbs. of potash is wanted, to which we must add the potash in the chloride of potassium, 4½ lbs., which will make the whole amount to 237 lbs. and 105 lbs. of phosphoric acid. For practical purposes, therefore, the mineral ingredients for the two rotations so nearly approximate that they may be taken as identical, and may be supplied in potash by 4 cwt. of sulphate or nitrate of potash,* (saltpetre,) and phosphoric acid by 4 cwt. to 4½ cwt. bones.

It has been shown that 20 tons of ordinary farm-yard manure contain 156 lbs. of potash and the same quantity of phosphoric acid—or the equivalent of potash required for a four-course rotation, and one-half more phosphoric acid than is required for such a course. It is evident, therefore, that the additional 100 lbs. of potash must be extracted from the soil: unless the field in aration consists of a soil somewhat rich in potash, it follows that its fertility

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given by Professor Way, who remarks that the mineral matter of barley, deducting the silica, very closely resembles that of wheat: thus, of a specimen which gave 2.28 per cent of ash, 0·74 per cent is silica, leaving 1·51 per cent of other bodies. In 100 parts of the ash there would be—

Phosphoric acid,	47·10
Magnesia,	11·00
Lime,	2·20
Potash,	30·80
Soda,	6·83

A crop of					Mineral constituents, per cent.
45 bushels of oats	at 42 lbs. per bushel	=1890 lbs.	at 2·60 per cent ash	=	49 lbs.
40 „ barley	at 48 lbs. „	1920 lbs.	at 2·20 „		42 lbs.
30 „ wheat	at 61 lbs. „	1830 lbs.	at 1·67 „		30 lbs.

The principal substances would be distributed in the following proportions:—

	Phos. acid.	Magnesia.	Potash and soda.	Silica.
Wheat	13·5	3·6	10·2	1·5
Barley	13·4	3·0	10·5	12·5
Oats	10·6	4·3	7·5	25·0

As oats are frequently used as a white crop after turnips, I give the following analysis of the ashes of that grain in 100 parts, deducting the silica, viz.:—

Phosphoric acid,	43·00
Magnesia,	17·00
Potash,	28·00
Soda,	3·00

For a most elaborate analysis of the oat crop, see Prize-essay of Mr John Pitkin, Norton, in the Number of the Highland and Agricultural Society's Transactions for July 1846.

* Sulphate of potash, commonly called sal-enixium,	48 lbs. potash......... 40 lbs. sulphuric acid	88
Nitrate of potash, commonly called saltpetre, ...	48 lbs. potash......... 54 lbs. nitric acid	102

Bones are roughly estimated to contain 30 per cent phosphoric acid, or rather more than one-half of their weight of phosphate of lime.

will gradually and perceptibly decrease. The cultivator then lays the same down to permanent pasture, in order to recruit itself—or, as he usually terms it, *gives it a rest.* This recruiting is performed by the aid of the earth-worm, which brings up from the subsoil its finely disintegrated particles, and leaves the same on the surface as a top-dressing. Soils rich in potash and phosphoric acid need never be thrown out of cultivation, provided some nitrogenous substances are occasionally applied to them: it is only soils that are poor in these substances which require to be frequently laid down to permanent pasture; and from the occupiers of which the outcry of being turnip and clover sick so frequently is made. Such soils will generally be found to consist of poor chalks, sands, and wolds; and those rarely requiring to be turned into pasture-lands, are clays (if drained) and other rich stiff soils—an illustration of which will be given hereafter.

As 20 tons of farm-yard manure only contain sufficient potash to supply little more than the wants of the first crop of the rotation, it follows as a matter of course that, in order to furnish the succeeding crops with this important alkali, (unless the soil will furnish the same, or is of that description usually denominated a naturally fertile one,) we must apply an additional quantity of farm-yard or special manure: and it would clearly be absurd to apply the former, as there has been already applied more phosphoric acid than will be wanted by the remainder of the rotation; and by adding more we should be clearly adding a superfluity of this substance; while, by using a special manure, we obviate this evil.

Having arrived at this point, it will be well to determine the relative cost and comparative advantages and disadvantages of farm-yard and special manures.

Farm-yard Manure.

20 tons containing—

Phosphoric acid,	. . . .	156·80 lbs.
Potash,	. . . .	156·80 „

Special Manures.

	cwt.	qrs.	lbs.	
Nitrate potash,	1	1	0	
Sulph. do.	1	1	0	
	2	2	0	containing 144 lbs. potash and 17½ lbs. nitrogen.
Sulphate ammonia,	0	1	0	
Super-phosph. of lime,	2	0	0	containing 50 lbs. of phosphoric acid.
	4	3	0	

The above are set one against the other for the first crop of the rotation. I have not entered into the minutia of salt, as I consider the inorganic matter in the super-phosphate of lime will be equivalent to the value of such articles of small value in the farm-yard manure. The respective cost of these two modes would be as follows:—

20 tons farm-yard manure at 5s. 6d. per ton, including carting, spreading, &c.,		£5 10 0
1¼ cwt. nitrate of potash, at £1, 6s.,	£1 12 6	
1¼ cwt. sulphate do., at 14s.,	0 17 6	
2 cwt. superphosphate of lime, at 7s.,	0 14 0	
1 qr. sulphate of ammonia,	0 4 0	
		3 8 0
Outlay,		2 2 0
		£5 10 0

ing an outlay of £2, 2s. on the first crop more than would be quired were special manures applied. It is true that an excess phosphate of lime remains from the farm-yard manure, for the of the succeeding crops; and also a much greater amount of rogen is present than in the artificial manure. In order more ly to explain the matter, I will proceed to take into considera- n the expenditure required on each method during the whole ation, making up the deficiency of the farm-yard manure by aid of sulphate of potash; but, prior to doing so, I have to tice a matter mentioned by Mr Lawes, in a paper written by that ntleman, and published in the *Journal of the Royal Agricultural ciety of England*, relative to some experiments made by him th certain special manures,—viz. that superphosphate of lime pears to exercise some special influence on the growth of plants, rticularly turnips and wheat, irrespective of the fact of its sup- ying an important mineral ingredient; and this inference has been awn from the fact that it has been generally observed that wheat own after superphosphate of lime usually contains a larger nount of gluten, and consequently more azotised matter, than ien that grain has succeeded other mineral manures, applied her immediately to the crop or to the preceding green crop. iis suspected special function is none other than the fact, that phosphoric acid of the superphosphate fixes the ammonia which scends from the atmosphere during rain, forming phosphate of monia, and neutral phosphate of lime; but the superphosphate lime rarely remains long in the soil as superphosphate, being mediately converted into the neutral phosphate, on coming in tact with calcareous matters existing in the soil, in the form of bonates; which latter circumstance only alters the action in gree, as it has been found that bone, subjected in the soil to the ion of rain and carbonic acid, gradually yields its phosphoric d, and becomes converted into the carbonate of lime. In using ies, therefore, whether boiled, burned, or raw, we indirectly ord a source of nitrogen to crops, by its property of fixing the monia existing in rain, in the manner just alluded to.

To return to the question of the relative cost of farm-yard and cial manures, I shall endeavour to explain it by the following ount, viz.:—

Farm-yard Manure for the four Courses.

				Containing		
				Phos. acid. lbs.	Potash. lbs.	Nitrogen. lbs.
20 tons farm-yard manure, at 5s. 6d., including cost of carting, spreading, &c., ...	£5	10	0	156·80	156·80	90
1½ cwt. sulphate of potash, at 16s. per cwt., . . .	1	4	0		91·64	
Total, . .	£6	14	0	156·80	248·44	90

Special Manure for the four Courses.

				Containing		
				Phos. acid. lbs.	Potash. lbs.	Nitrogen. lbs.
1¼ cwt. of nitrate of potash (saltpetre), at 26s., . .	£1	12	6		65·88	17·5
3 cwt. sulphate potash (sal enixium), at 14s., ...	2	2	0		194·75	
3½ cwt. superphosphate of lime, at 7s.,	1	4	6	109·50		12·0
2 cwt. sulphate of ammonia, at 14s.,	1	8	0			55·0
Total, . .	£6	7	0	109·50	260·63	84·5

Thus, by adding 1½ cwt. of sulphate of potash to 20 tons of farm-yard manure, the required amount of potash for a four-course rotation will be obtained. By the preceding contrasted details it will be seen that the relative cost of obtaining the mineral constituents of a four-course shift is much alike, valuing the manure and labour of spreading, &c., at 5s. 6d. per ton; and it will also be seen that the quantity of phosphoric acid and nitrogen is greater in the farm-yard manure, whilst the potash preponderates in the special manures: but the relative value of each will doubtless be found somewhat equal, as the nitrogen in the farm-yard manure will be given off principally as carbonate of ammonia, and consequently more susceptible of escaping, without being assimilated by the plants, than if it were in a fixed form, as the sulphate, muriate, &c. On the other hand, as the mineral ingredients of the farm-yard manure are, the greater part, in intimate connexion with the vegetable matter of the manure, and thus only slowly set free during the progress of decay, loss on this score will, therefore, be less with farm-yard manure than with the special manures, in which the potash exists in the form of soluble salts as the nitrates and sulphates, which is one reason why special manures should only be applied to each respective crop, and not the whole to the first crop of the rotation. In general, special manures are only applied to grain crops, as top-dressings, towards the latter end of April or beginning of May; if desirable, a small amount of special manure might be applied to the wheat crop say about half a hundred-

per acre—at the time of sowing, which would be amply
it to supply it with manure during the slow growth of win-
l the bulk subsequently applied from the end of March to
ldle of April.
nportant element connected with the application of every
manure is generally lost sight of—viz., the annual fall of
the district—varying so greatly as it does in different parts
kingdom not wide apart from each other, as will be seen
le following table of the annual fall of rain at the places
ated during the year 1845:—

	Inches.		Inches.
l, Northumberland,	56·411	Rampside, Lancashire,	40·289
ields, do.	26·200	Manchester, do.	41·415
Cumberland,	31·280	Liverpool, do.	34·06
'en, do.	49·207	Easthwaite Lodge, do.	84·00
t, do.	53·000	Doncaster, Yorkshire,	29·198
uth, do.	46·930	Leeds. do.	25·586
do.	62·202	Highfield House, Nottingham,	29·595
e Lake, do.	76·880	Cirencester, Gloucestershire,	28·970
ter, do.	69·542	Uckfield, Sussex,	25·030
re Lake, do.	87·48	Empingham, Rutlandshire,	24·610
Head, do.	108·55	Stratton, Cornwall,	40·890
e Borrowdale, do.	151·87	Helston, do.	37·800
Hall, do.	35·000	London, (average)	25·00
, Westmoreland,	121·08	Culloden, Scotland,	25·586
h, do.	124·13	Arbroath, do.	28·211
Head, do.	136·00	Kelso, do.	24·442
do.	53·346	Merchiston, do.	21·270
Moors, Lancashire,	48·110	Applegarth Manse, do.	30·320
do.	53·665		

the above table it will be seen that, according to the
to which manures are to be applied, they ought to be made
less soluble or insoluble. In an ordinary way, such soluble
nitrate, sulphate and muriate of potash, sulphates and
s of ammonia, &c., will be washed out in one season.
ve rise to Liebig's patent manure, which, by combining
aline salts with calcareous substances, thus rendering them
ble, a manure was formed perfectly correct in principle, and
ave been a very desirable improvement in the manufacture
res, had it been thoroughly carried out. But, unfortunately,
mercial article was composed of lime in combination with
stead of potash, which, together with the attempt to do
ammonia, or other azotised matter, was the cause of the
inted expectations of those who used this manure. In
iebig's manure, containing soda in the place of potash,
ed the singular anomaly of a manure being manufactured
ame, while it was composed of materials different from
ecommended in his Chemistry as applied to Agriculture.
nt, however, respecting the rendering the salts of the alka-
e—potash—less soluble, is one of considerable importance in
where the annual fall of rain is considerably above an
—such as those noticed in the preceding table as occurring

in the lake district of England, which is analogous in many respects to the country north and west of the Clyde, including the whole of the Western Highlands of Scotland. At Low Furness—a very rich fertile tract of land in Lancashire, adjacent to Rampside, and situate between that place and Cartmel—it is always observed that, after very wet winters, the soil requires a greater amount of manure to produce an average crop: the principal part of the soil is peroxide of iron, alumina, and silica, each in a very finely-divided state—so much so as to have the appearance of rouge, or polishing powder. The soil is formed from the decomposed matrix of the kidney iron-ore, (hematite,) which is largely dug here, and minutely decomposed felspar; and it may be expected, from the sources whence it is derived, to contain phosphoric acid and potash, which is washed out by heavy winter rains as fast as the minerals are decomposed.

Should it be thought desirable that special manures should be applied like farm-yard manure—viz., the whole supplied to the first crop of the rotation—the loss, likely to arise from the liability of several of the salts composing the special manure being washed out by the rain, can be obviated by the chemist previously combining them with lime. In this way, any required degree of insolubility may be given to them. I am strongly of opinion, notwithstanding the advantage that can thus be obtained, in practice it will be found more advantageous to apply a special manure to each particular crop—thus preventing great chance of waste, and certainly saving interest of money and premature outlay of capital. I have, in the first part of this Essay, published in the last October Number of this Journal, alluded to the fact of guano, salts of ammonia, superphosphate of lime, alone or combined, having produced luxuriant crops without the aid of potash; and in the case of ammonia also, without a substance containing phosphoric acid—which can only be explained by the circumstance of phosphoric acid and potash being present in the soils when ammonia has been applied, sufficient in quantity to supply the wants of the crops growing thereon. On this very important, and not very generally understood subject, I may be permitted here to refer to a very valuable paper of Dr Daubeny's "On the Dormant and Active Ingredients of Soils," published in the *Journal of the Royal Agricultural Society of England*, being a portion of his Bakerian Lecture for the year 1845, in which he justly observes,—

Let us take the case of a natural soil composed of certain kinds of disintegrated lava, or even granite, in which it is evident that an actual analysis would detect the presence of a large percentage of alkali—probably a certain amount of phosphate of lime—and, in short, all those ingredients which plants require for their support in sufficient abundance. Nevertheless, land of this description, in consequence of the close union of the elementary matters of which it consists, and the compactness of its mechanical texture, *might be as barren*, and as incapable of imparting food to plants, as an artificial soil composed of pounded glass is known to be, notwithstanding the large proportion of alkali contained in it.

In order, therefore, to ascertain the respective amount of the active and dormant ingredients existing in soils, Dr Daubeny digested some soil for four or five successive hours in muriatic acid: considering that, whatever cannot be extracted from a soil by such a digestion, must be in that state of combination as will render it totally incapable of imparting anything to a plant—for such a period of time, at least, as can enter economically into the calculation of the agriculturist; and, moreover, that all which muriatic acid extracts, but which water impregnated with carbonic acid fails in dissolving, ought to be regarded as contributing nothing towards present fertility—although it may ultimately become available as food for plants. In this manner, by a careful analysis of the soil of the botanic garden, Oxford, Dr Daubeny ascertained, that within an area of 100 square feet, and a depth of 3 feet from the surface, it contained 3·5 lbs. of phosphoric acid, 6·9 lbs. potash, and 2·9 lbs. of soda—all in a state to be separated from the general mass by muriatic acid. That the above, however, were for the most part in a dormant condition, appeared from the much smaller amount of the same which could be extracted by water containing carbonic acid; for it was found that, of all the alkaline sulphates,* not 11 lbs. could be procured by these means, instead of 19·2 lbs.

By operating in a similar manner upon soils of the same quality as the above, which had *been exhausted by several years' previous cropping*, it appeared that the amount of the ingredients alluded to as *dormant* in the soil, did not much vary from the above-quoted instance, but that the amount of the *active ones was* beyond all comparison *greater* in the sample of *unexhausted* soil.

The action, therefore, of any single specific manure, or manure containing other than the whole of the mineral ingredients of a crop, can only be productive of fertility, by exhausting the soil of one or more of its active ingredients; and, on this point, it would be well to notice the effect which a special manure, not containing all the mineral constituents of a crop, has in converting matters in the soil from dormant or passive into active ones;—such as ammonia rendering dormant or passive potash or phosphoric minerals active, or superphosphate of lime rendering dormant potash matters active, and the reverse of the latter case. That some such action takes place I am induced to believe; and I think every reflecting practical farmer will concur with me in opinion, when his attention is drawn to the circumstance, that it is an important point, which has not hitherto been, but which is certainly well worthy of being investigated. Before leaving this important question of the dormant and active ingredients in soils, which also bears a strict relation to the active or dormant condition of the substances applied as mineral food for crops, I shall briefly allude to some important experiments made by Professors W. B. and R. E. Rodgers, of the

* The alkalies, for convenience, were estimated as sulphates.

University of Virginia, published in *Silliman's Journal*. The experiments were made to decide whether water—pure, or charged with carbonic acid—possessed the general decomposing and dissolving power usually ascribed to it; or whether this action is manifested only with those substances which contained an alkali. The result of these experiments have proved, most conclusively, *the solvent and decomposing power of pure and carbonated water upon all the important mineral ingredients, without, as well as with, alkaline ingredients.*

The experiments were of two kinds,—first, by an *extemporaneous method with the tache*; and, second, by *prolonged digestion* at the ordinary temperature.

In the former method, a small quantity of the mineral, some five or ten grains, in *very fine powder*, was leached for a few moments on a small filter of purified paper, and a single clear drop of the liquid received on a platinum slip, afterwards dried, and examined by appropriate tests, before and after ignition. In the second process, a quantity (40 grains) of the finely-powdered mineral was placed, with a certain volume (10 cubic inches) of the liquid, in a green glass bottle, and agitated from time to time for a prescribed period. The liquid separated by filtration was then evaporated to dryness in a platinum crucible,—the residuum examined, and, if of sufficient amount, submitted to quantitive analysis.

In both processes, two parallel processes were made, the one with pure de-aërated water, the other with water charged with carbonic acid, to saturation, at a temperature of 60°. In the second process, the alkali, lime, &c., which might be dissolved by action on the containing glass, were determined by parallel experiments with bottles of the same kind, charged, the one with simple water, the other with carbonated water, and exposed to the solvent action for the same time, and with the same agitation, as those containing the powdered minerals.

The following is a list of the substances which were thus subjected to the analytic action of pure water, and water charged with carbonic acid.

Potash felspar (3 var.), soda felspar, lethia felspar, glassy felspar, labradorite, mica (2 var.), luecite, analcime, mesotype, scolecite, schorl (2 var.), greenstone (2 var.), chalcedony, obsidian, lava, gneiss, hornblende slate, chlorite (2 var.), talc (2 var.), serpentine, steatite, olivine, hypersthene, hornblende (2 var.), actinolite, tremolite, augite, asbestus (2 var.), coccolite, epidote massive, epidote chrystals (2 var.), axinite, Prehnite, brown garnet, dolomite, flint-glass, green bottle glass, green German glass, hard white Bohemian glass, wedgewood mortar, Chinese porcelain, soils, anthracite, bituminous coal, lignite, charcoal, ashes of coal and wood, woods.

By the tache process, it was found that all the minerals and glasses in the above list are partially decomposed and dissolved by carbonated water; and most of them, also, by pure water.

When the substances were very minutely powdered before mingling with the liquid, the first drops that passed the filter commonly gave a tache containing some of the alkali, or alkaline earth, that had been dissolved. In this way, proof of the solvent power of the carbonated water may generally be obtained in less than 10 minutes after adding it to the powder. As the action is continued, by returning the liquid to the filter, the effect is increased. In the case of simple water, the result is much feebler, and requires a longer time. But, with nearly all the substances enumerated, the test is entirely unequivocal, and in some cases intense. By *the second method*, that of prolonged digestion, the specimens exposed to the carbonic acid water for forty-eight hours, and to simple water for one week, have, in many instances, furnished a sufficient amount of material to the liquid, to admit of a quantitive examination.

Thus, from hornblende, actinolite, epidote, chlorite, serpentine, felspar, mesotype, &c., lime, magnesia, oxide of iron, alumina, silica, and alkali were procured, the dissolved ingredients of these minerals severally amounting to from 0·4 to 1 per cent of the whole mass—the lime, magnesia, and alkalis in the form of carbonates; the iron in the case of hornblende, epidote, &c. passing from the state of carbonate to that of peroxide during the evaporation, was collected as brown flocculi, along with the silica and alumina, at the bottom of the capsule. Thus, 40 grains of hornblende, digested for forty-eight hours in carbonic acid water at 60°, with repeated agitation, yielded—silica 0·08, oxide of iron 0·05, lime 0·13, magnesia 0·095, manganese a distinct trace.

Most of the substances previously enumerated, when finely divided in an agate mortar, and moistened with *pure water* in a platinum capsule, *gave decided alkaline reaction* with test-paper properly prepared. Among the materials presenting this effect most strongly were serpentine, chlorite, tremolite, asbestus, mica, hornblende, the felspars and glass. The effect was particularly striking with powdered glass: it was noted that the reaction was more immediate and stronger with the magnesian calcareo-magnesian silicates than with the felspars and most other alkaline minerals.

Simultaneously with the preceding experiments, Dr John Davy was pursuing a similar series at the Island of Barbadoes; and as the two sets of experiment by the Messrs Rogers and Dr Davy, were carried on without concert or knowledge of each other's operations, it is satisfactory to know that, when like means were possessed, like effects were produced. Dr Davy's experiments, however, were productive of too important results to be passed over without a somewhat lengthened notice.

The doctor's first trials were made with phosphate of lime, silica, and alumina. Portions of these (all with the exception of the sulphate of lime) were used in a moist state, freshly precipitated, after having been well washed on a filter. They were introduced into bottles, such as are used for holding soda-water, and were filled with water strongly impregnated with carbonic acid gas, by means of the apparatus commonly employed in the manufacture of soda-water, and were corked and wired in the usual manner. The degree of the compression of the gas was not ascertained; that it was considerable was evident from the explosive manner in which the corks were expelled on removing the binding wire, for the purpose of examining the effects. In each instance, on the removal of the corks, the water was filtered as soon as possible, using three or four filters; and, as a general remark, there was no appearance of any turbidness, or precipitation, or the escape of the highly compressed gas seeming to indicate that any solvent power was exercised by the compressed air.

In each instance the filtered liquid was carefully examined, subjected to such trials as were requisite to determine whether, and to what extent, the substance had been acted on by the acid; and the results were as follows:—

Phosphate of lime.—After having been kept eleven days in carbonic acid water, the water was examined. Immediately after filtration it was clear. The whole was divided into two portions: to one ammonia was added, the other was left exposed to the air. The volatile alkali instantly rendered the water turbid; six cubic inches of the water yielded a precipitate, which, collected and weighed, after having been dried and heated to redness, was found equal to ·64 o fa grain. It had the properties of phosphate of lime. The other portion exposed to the air, about 8·5 cubic inches, examined after two hours, was found to have on its surface a fine continuous pellicle,

not unlike that which forms on lime-water similarly exposed. Examined again, after fourteen hours, the pellicle had become more conspicuous, and a deposition was observable on the inside of the glass vessel diminishing downwards. The pellicle, examined under the microscope with a high power, (one-eighth of an inch focal distance,) appeared finely granular—portions of it with well-defined broken edges, other portions with a delicate arborescent outline. The pellicle formed on the surface, and the deposit on the sides of the vessel, collected on a filter, after thirty-eight hours' exposure, and thoroughly dried, weighed ·07 of a grain. Still the water held carbonic acid and phosphate of lime in solution; for, on addition of ammonia to the filtered fluid, it was rendered turbid, and yielded 0·3 of a grain more of phosphate of lime. These results show that 20,000 parts by weight of water, saturated with carbonic acid gas, are capable of dissolving 1 part by weight of phosphate of lime. The readiness by which phosphate of lime is dissolved by means of carbonic acid, is most easily shown by adding a portion of freshly precipitated phosphate, well-washed, to water merely saturated with carbonic acid gas by agitation. In a few minutes, if the portion be small, it will disappear, and will be precipitated distinctly by the addition of ammonia.

Sulphate of lime.—Dr Davy's experiments with gypsum and water, saturated with carbonic acid, were negative; the same with alumina. Carefully-conducted experiments have, however, shown that gypsum is soluble in 420 times its weight of distilled water.

Silica.—From an experiment in which some silica that had been obtained from a mineral water, in fine powder, was exposed, after being dried, to the action of water containing carbonic acid gas compressed, for nineteen days, the results were a minute quantity of silica on evaporating the solution to dryness—viz., from 6 cubic inches of solution, 0·6 grains of silica were procured.

In another experiment, in which a white powder, consisting chiefly of the silicious skeletons of infusoria, had been exposed to the action of water saturated with carbonic acid, without condensation, for fifteen days, a similar result was witnessed on evaporation—viz., a minute residue of silica. Among other experiments by Dr Davy, in illustration of this subject, were the following:—

A portion of calcareous marl, in fine powder, acted on for fourteen days, by water containing carbonic acid gas, condensed, yielded, after filtration, on exposure to the air, and evaporation to dryness, some carbonate of lime, a little carbonate of magnesia and phosphate of lime, a trace of silica, and a minute portion of carbonate of potash.

In a similar experiment, continued for the same time, on a portion of the ashes of the sugar-cane, the carbonic acid water yielded a considerable portion of phosphate of lime, and of carbonate of potash, and a small proportion of carbonate of potash and magnesia, with a little silica and a trace of carbonate of lime—results in harmony with the composition of this ash, as the following analysis will testify:—

Analysis of the Ash of the Sugar Cane in 100 *Parts.*

Potash,	1·86
Soda,	1·75
Lime,	11·55
Magnesia,	6·08
Oxide of iron,	3·56
Chloride sodium,	1·27
Phosphoric acid,	7·65
Sulphuric acid,	1·95
Silicic acid,	63·88
	99·55

A portion of the subsoil from the Island of Trinidad was similarly acted upon for eighteen days. The carbonated water then yielded a little carbonate of lime, a very little carbonate of magnesia and phosphate of lime, a trace of silica and carbonate of soda. A mixture of two grains of bicarbonate of potash, and of four grains of chalklike matter—of which there are extensive depots in Barbadoes, consisting chiefly of silicious skeletons of infusoria—was acted on by water containing carbonic acid gas, compressed for eleven days. This water, when filtered and evaporated, yielded, besides the alkaline salt, a trace of carbonate of lime and magnesia, and of phosphate of lime and silica. The quantity of silica obtained in this instance, notwithstanding the presence of a large proportion of the vegetable alkali, was not more in quantity than when no alkali was introduced.

A mixture of four grains of dried phosphate of lime, and the same quantity of carbonate of lime and of the chalklike matter previously mentioned, all in the state of

ine powder, was similarly acted on for fifteen days. When examined, the carbonated water was found to yield some carbonate of lime, a minute portion of phosphate of lime, of carbonate of magnesia, and a trace of silica.

The above results are important, showing, as they do, that water impregnated with carbonic acid has the power of dissolving, at the same time, several compounds—as carbonate of lime, carbonate of magnesia, phosphate of lime, and silica—besides what water alone is capable of taking up; and show that, in order to produce the most beneficial results from the application of any special manure, we ought, at the same time, to apply them mixed with some carbonaceous matter, whose slow decay will give rise to the evolution of carbonic acid gas—and to its evolution during the decay of the carbonaceous portion of farm-yard manure, I attribute the superior effects on a soil containing a considerable amount of carbonaceous matter. This may not be of great consequence; but on soils deficient in vegetable substances, it would be well to imitate farm-yard manure, by mixing the special manure with a few hundredweights of ditch scrapings, or bog stuff previously saturated with lime, and exposed to the weather for a month or two prior to use, during which period it ought to be turned over twice or thrice.

One of the most important deductions from the preceding experiment is the remarkable solvent power of carbonic acid on precipitated phosphate of lime. The precipitated or neutral phosphate of lime is the form which I recommended for use at the Northampton meeting of the Royal Agricultural Society of England, because it possesses the quality of being sufficiently but not too easily soluble, whereas the superphosphate of lime, if even honestly prepared, contains one part too soluble, (the superphosphate,) and another part very insoluble, the bone phosphate surrounded by sulphate of lime. If muriatic acid is used in its formation, instead of sulphuric acid, the whole mass will be excessively soluble—unless the superphosphate become converted into the neutral phosphate in the soil, by the action of the calcareous and alkaline matters existing therein, in the form of carbonates.

As an addendum to the preceding remarks and experiments, I will here detail an experiment which was made in Cornwall, respecting the length of time which an application of bones might be deemed to serve crops with phosphoric acid: it will be found in Mr Karkeek's excellent report of the agriculture of that county; and Mr Karkeek and Mr Trethewy assured me, at the York meeting of the English Agricultural Society, in July last, that the line of demarcation between the boned and unboned portions of the field were still well defined, after a lapse of thirteen years.

A piece of several acres was enclosed in 1835, and put into turnips: one portion of it was manured with bones, at the rate of 24 bushels per acre; the other portion of the field was simply manured with the ashes obtained from breaking up and burning the land. In the years 1836 and 1837 it was successively cropped with oats, and then laid down to permanent pasture. At the present time,—nearly ten years since it was first broken from the waste, which was nothing but heath and furze,—the effect of the bones can be plainly distinguished as far as the eye can reach, as if

a line of demarcation had been drawn between a rich grass sward and a poor scanty pasture.

This, and a dozen other experiments of the same kind, have attracted the attention of a great many persons interested in agriculture; and the Probus Farmers' Club, with a view of ascertaining whether the presence of bone could be detected by analysis, as it could assuredly be by the appearance of the pasture, sent samples of the soils (one from each part of the field) to Mr Hunt for this purpose; and, with a view of testing that gentleman's analytical abilities, he was kept entirely ignorant of the object of the Club. The following is the result:—

	Unboned soil.	Boned soil.
Water evaporated by stove-drying,	14·06	14·18
Vegetable and animal matter burnt,	12·01	12·05
Silica and siliceous grit,	49·54	49·50
Oxide of iron,	7·30	7·00
Carbonate of lime,	1·05	1·06
Carbonate of magnesia,	0·25	0·35
Sulphate of lime,	1·05	1·04
Muriates,	0·54	0·54
Alumina,	7·10	6·04
Phosphate of lime,	0·10	0·75
Do. magnesia,	0·00	0·05
Potash,	1·00	1.27
Humus, soluble in alkalis,	6·00	6·17

Thus it is proved that bone-dust remains in the land, and continues to act as manure, for so long a period as ten years.

As only three crops were taken from the ground,—viz., a turnip crop, and two crops of oats,—it may be safely inferred that these crops, combined, did not carry off more than 80 lbs. of phosphoric acid—which is only a very small portion of the phosphoric acid contained in 24 bushels of bones, which would amount to not less than 400 lbs.,—and therefore accounts for the percentage of phosphoric acid in the soil being increased from 0·10 to 0·75 per cent, as very little phosphoric acid would be carried away by cattle grazing; and its remaining so long in the soil is to be accounted for by the fact of the bones being only roughly ground, and consequently less susceptible of being rendered soluble. In the preceding analysis we have an exemplification of the theory I alluded to in a former part of this paper, respecting the property which the application of any single special manure has of setting free, or enabling plants to assimilate, a larger portion than they otherwise would be capable of doing of the other dormant or passive ingredients of the soil on which they grow, and which are necessary to their perfect development. The increase of potash, from 1 per cent on the unboned to 1·27 per cent on the boned, can only be accounted for from the circumstance that the phosphoric acid and nitrogen of the bones so far stimulated the growth of the turnips, oats, grass, &c., as to assimilate a corresponding addition of potash; and thus, by the deeper protrusion of the roots of the plants drawing to the surface a portion of their supply from the subsoil, and by their subsequent decay, either naturally or in the state of excrements, after serving for food to the cattle grazing thereon, has tended to increase the amount of potash in the soil, and consequently added to its fertility. There is the stronger reason for suspecting this to be the case, as at least 100 lbs. of potash must have been taken

away in the three first crops, and an amount, during the remaining period, certainly equal to the phosphoric acid carried away; notwithstanding which serious deductions, the amount *of potash in the soil increased* 27 *per cent.* It is the peculiar action here alluded to, and which I am not aware any previous observer has noticed, to which must be ascribed the continued empiric field-experiments which are made, and which has led the farmer on the large scale to rely on manures,—such as guano, bones, superphosphate, ammonia, &c.,—for fertility, though not containing all the mineral constituents of the crops which he cultivates. But the continued following up of such empirical applications must eventually lead to disappointment and loss, as the time will arrive, sooner or later, when his fields will cease to be fertile, notwithstanding the application of his long-relied-on but single renovator. It is a constant cry with farmers that they prefer practice to theory—all of which is very good; but, it may be asked, how far do farmers follow out this adage? We find them apply guano alone, or in combination with superphosphate; ammonia alone, or with superphosphate—sometimes one or other, but *very seldom* combined with a potash-salt. Seeing the good results derived from such empirical applications, is it too much for a chemist to say—Apply potash, phosphoric acid, and nitrogen, in their due proportions; salt, magnesia, lime, and gypsum also, if the soil is deficient of the same? If you get good crops from the use of ammonia, are you likely to get worse by combining with it bones for phosphoric acid, and a potash-salt in order to furnish potash?—and particularly when it is known that either of the two latter, applied alone, is productive of good effects, why not combine them, according to the advice of the chemist, instead of railing at him for being a theorist? In truth, in such cases it is the farmer who is the theorist, combining as he does, at hap-hazard, a number of salts of which he knows nothing; but of which, if they happen to accompany a good crop, he exclaims, "This is practice!—I like practice! I dislike theory: no theory for me!"—at the same time obtusely shutting his eyes to the true rationale of chemistry, as applied to practical agriculture. It remains to be seen whether farmers will in future shut their eyes to the plain truths which chemistry points out to them, and which it is the humble intention of the writer of this paper to place before them in as plain and popular a manner as the subject will admit of, in plain language. Potash, (as sulphate, muriate, or nitrate,) phosphoric acid, (as bones, superphosphate, or coprolites,) nitrogen, (as sulphate, muriate of ammonia, &c.,) or guano, which contains phosphoric acid and ammonia, combined in their due proportions, ought to form the substance of all special manures, as a general rule,—the exceptions being when one or more of these substances are available in excess in the soil beyond the wants of the crop, an illustration of which will be given hereafter.

I have, both in the calculations of expense, and also as regards

their chemical and physiological importance as sources of nutriment to crops in general, hitherto kept out of view several of what may be termed the minor constituents of plants—minor only on account of their relative amount, or pecuniary value to the crop itself. Each constituent, in its due proportion, is as important as any other mineral component part of the plant, though a less weight may be required, or may relatively be of less consequence, from its inferior commercial value as compared with another of more costly price. For the above reasons, and for the sake of simplicity, I have kept out of the details such articles as salt, &c., in comparing the value of farm-yard manure and special manures, in both of which will be found a greater admixture of substances than will be required for a crop or a given series. It must not, however, be lost sight of, that with some of these substances, and probably with the relatively more important ones, plants require a greater amount of certain descriptions of mineral food at one stage of their growth than at another: this is particularly exemplified in Mr Norton's analysis of the oat in the *Highland and Agricultural Society's Transactions* for July 1846.

Composition of Ash from the Leaf of unripe Oats, at different periods of its growth.

	DAY OF THE MONTH RECEIVED.						
	June 4.	June 11.	June 18.	June 25.	July 2.	July 9.	July 16.
Potash and soda,	24·60	23·51	26·21	28·10	18·78	16·09	18·35
Chloride of sodium,	16·34	13·54	11·30	7·56	7·92	4·09	0.30
Lime, . .	8·44	7.24	7·33	6·74	6·91	5·93	5·13
Magnesia, .	5·33	3·11	3·47	3·06	2·39	2·35	1·63
Oxide of iron,	0·61	0·52	0·72	0·99	0·40	0·34	0·55
Sulphuric acid,	11·74	12·85	10·59	7·88	9·50	6·45	13·05
Phosphoric acid,	16·16	10·57	10·12	8·76	6·92	6·44	2·91
Silica, . .	16.58	28·54	30·31	36·50	47·62	58·28	58·22
	99·80	99·88	100·05	99·59	100·14	99.97	100·14

Composition of the Ash from the Stalk of the unripe Oat Plant.

	DAY OF THE MONTH RECEIVED.						
	June 4.	June 11.	June 18.	June 25.	July 2.	July 9.	July 16.
Potash and soda,	24·94	21·45	26·49	28·86	36·26	30·10	42·43
Chloride of sodium,	32·66	34·65	24·94	24·57	11·62	17·82	4·46
Lime, . .	2·40	4·22	3·74	2·42	2·64	1·60	4·12
Magnesia, .	0·88	3.20	2·20	2·58	1·17	2·27	1·47
Oxide of iron, .	0·39	0·30	0·40	0·58	0·88	0·68	0·62
Sulphuric acid,	6·15	7·82	8·51	4·87	7·98	9·09	7·84
Phosphoric acid,	16·15	13.96	12·55	7·81	2·21	5·57	6·31
Silica, . .	16·29	14·32	20·41	28·08	36·64	32·39	34·85
	99·86	99·92	99·24	99·77	99·40	99·52	100·33

Composition of Ash from the whole Oat, at different periods of its growth.

	DAY OF THE MONTH RECEIVED.		
	July 2.	July 9.	July 16.
Potash and soda,	32·92	31·31	31·37
Chloride of sodium,	10·37	8·10	0·61
Lime,	2.70	5·40	6·76
Magnesia,	3·44	4·52	2·94
Oxide of iron,	0·39	0·21	0·35
Sulphuric acid,	10·35	12·78	16·42
Phosphoric acid,	14·02	20·09	15·19
Silica,	24·40	17·05	26·05
	98·59	99·46	99·69

According to the three analyses given, it will be seen that there ıas taken place a most rapid diminution in the amount of the chloide of sodium (common salt) present in the leaf, stalk, and whole ›lant. Unfortunately, the soda and potash are classed together. A question, however, arises—Does the young plant require a larger ›roportion of its mineral constituents, or any single one, than the ıggregate amount required by the matured plant? In so far as :ommon salt is concerned, this appears to be the case, and may ›erhaps be so with some other of its mineral ingredients; and it is rue that the matured plant, being of greater weight, may contain ıs much inorganic matter as that contained by the young plant, in , more concentrated state, which can hardly hold good with respect o common salt; but the discrepancy being so great, the facts here ;iven suggest the propriety of always supplying crops with *an excess* ıf their mineral constituents.

Theory would suggest that nitrates of potash and ammonia, ›hosphates of potash, ammonia, or lime, are the salts best adapted 'or the growth of plants, though all the experiments I have seen nade with these substances have been the reverse of beneficial; ınd whether this has arisen from over-doses, or some other unfore-ıeen circumstance, I am unable to say. It is sufficient to know hat so far their application has been adverse—and agricultural ıttainments, in connexion with chemistry, are generally, at the ›resent moment, at too low an ebb to calculate upon any very 'efined experiments; but, after the progress made during the last ıeven years, it would be too bold to hazard an opinion as to what the ıext seven may bring forth. Farmers may rely on this fact, that :hemistry, as applied to agriculture, will *stand or fall* by the fact of vhether luxuriant crops are produced or not by *the application of* ›*otash, phosphoric acid, and nitrogen, in their due proportions*,—ıalt, magnesia, &c., being also present.

In confirmation of the truth of the preceding observations, the report of Messrs Paine and Way on the phosphoric strata of the chalk formation may be adduced—a report interesting as a whole, showing as it does that, over a considerable extent of country, phosphoric acid, in the state of coprolites, can be found in sufficient abundance to form their collection an object of economic value not only to the occupiers of the surrounding district, but also for distant transport;* and the practical deductions to be made from this report are clearly in favour of the axiom above set forth. These phosphoric substances, taking the descending series, are found, according to the report alluded to, first in the third division of the chalk, or chalk-marl, and contain more argillaceous matter than the chalk; which latter consists of carbonate of lime, 96·06, phosphate of lime, 2·6, in 100 parts, with a little insoluble siliceous matter, &c. The chalk-marl is generally of a soft nature, and of a dirty gray colour, and readily decomposes into a fine powder, when exposed to the vicissitudes of the weather. Wherever it outcrops, the soil is distinguished for its fertility. The prolific crops of wheat, beans, and clover, which are grown with the aid of a comparatively small quantity of manure, evince its productive capabilities. *The application of bones has usually failed in producing any apparent benefit. It has very generally been experienced that manures, richly charged with nitrogenous matter*, have proved signally useful in this class of soils.

Alluding to the green band in the upper green sand, they observe that, in the parish of Farnham, the bed traverses its whole extent from east to west, *coinciding* with the line of *the very best hop grounds*—those which are perennially under hop-culture. It has been generally observed that, in wet summers, the growth of the bine of the hops upon these outcrops is too luxuriant, and consequently injurious to the crop, which invariably ripens later on these spots.† In dry summers, on the contrary, the crops are unusually and conspicuously large. The influence of this marl upon corn has been equally conspicuous, the wheat crops especially having always exhibited a far more vigorous growth than usual upon the outcrops. There is a very striking illustration of the effect produced by a narrow band of the green marl, which runs through a field of wheat at the north-east extremity of the parish. The strata here are nearly vertical, and the band is very thin, so that its direction across the field may be traced by a rank, green, luxuriant belt of wheat, about six feet in width. An arable field, in which the green marl is widely developed near the surface, is remarkable for its natural fertility, and has only received manure

* A considerable quantity of the sulphate of lime, made by professed manufacturers, has this year been made from coprolites.

† Here we have exhibited, in a natural form, the phenomena which take place in the year after manuring the land excessively with farm-yard manure.

thrice in nearly thirty years—viz., rags, bones, and guano. *Not the slightest good resulted from the bone manure*, although forty bushels per acre were put on.

It is unfortunate that Messrs Paine and Way did not in every case analyse the marl for potash: only in one instance have they done so, viz., with a portion of the marl which passed through the sieve in separating the fossils from the marl, which gave—

Insoluble siliceous matter,	32·81
Soluble silica,	29·14
Organic matter,	3·02
Phosphoric acid, (equal to 13·63 bone-earth phosphate,)	6·61
Carbonic acid,	2·30
Lime,	9·53
Magnesia,	1·97
Oxide of iron and alumina,	11·46
Potash,	3·10
Soda, nominal	99·94

Of five other analyses of the marl, where the potash is not estimated, there is an average deficiency of 2·5 per cent, which is very probably potash. An old quarry, from which, at some remote period, thousands of loads have been removed, has recently been reopened by the present proprietor, in consequence of his having carted a few loads, by way of experiment, upon some adjacent pasture-land, where the benefit arising from its application was most perceptible, especially in developing a good herbage of clover. A small quantity was also taken to another part of the estate, about a mile distant, and was put upon an arable field; *but in this case no advantage accrued.* A recent examination of this field demonstrated the cause of the failure, by indicating the presence of the identical phosphoric band in the subsoil, immediately below the spot where the marl was applied. The proprietor also mentioned a circumstance which occurred twenty years ago, when some of the marl from the pit alluded to was carted away to a neighbouring farm. The waggon once broke down, and its contents were thrown upon an adjoining field, and spread very thickly over a small space. The spot was noticed, during many successive years, on account of the superiority of the crops which grew there; yet, strange to say, this evidence was practically disregarded. This marl contains a percentage of

Carbonate of lime,	25·72
Phosphate of lime,	14.92
Potash,	2·69
Soda,	0·50

The above are practical experiments on an extensive scale, performed by the hand of nature, and prove that the addition of bones, &c., when phosphoric acid is present, is of no avail. Will farmers take a lesson from this circumstance? There is abundant reason

for believing that potash and phosphoric acid exist, in the marls above named, in quantities sufficient to supply an almost unlimited amount of crops; yet on such it has been seen that nitrogenous manures produce the most striking results, thus proving that supplying plants with the mineral ingredients of crops alone is not sufficient to produce fertility. The whole of the above-recited examples speak trumpet-tongued as to the course which should regulate the farmer in the application of his manures, whether farm-yard or special ones. Will he be guided in future by the beacon thus set before him? We shall see.

A very dangerous fallacy has been attempted to be propagated, that certain alkalis and earths can replace each other,—as soda in the place of potash, and magnesia in the place of lime. It is true that plants grown on soils containing a considerable amount of common salt, such as salt-marshes on the borders of the sea, are found to contain a greater proportional amount of soda than plants of a similar species grown in inland places; but no instance has ever been known in which potash has been wholly, or in the major part, replaced by soda. The same remark applies to magnesia.

THE FARMERS' NOTE-BOOK.—NO. XXIII.

Characteristics of the Year 1848. By J. Towers, Member of the Royal Agricultural Society of England.—The readers of this widely-circulating Journal must be aware, that during several years I have taken a retrospective view of the *Meteorological Phenomena* which have characterised the locality in which I reside. It might at first sight appear futile to allude to phenomena which occurred at the distance of four hundred miles from the northern capital of the United Kingdom, but when it is considered that distance has little to do with atmospheric agencies; that even in places almost in close proximity the weather may be altogether dissimilar; and, finally, that in all our agricultural reports the writers occasionally advert to conditions of weather existing in quarters far remote, it will be admitted that if we do not acquire much knowledge of *causes*, we assuredly become instructed by a comparison of results, by similar registers, and at certain given periods. On the present occasion, I hope, this cursory review of the past year will be peculiarly interesting. The writer's experience and recollection embrace a period of more than half a century, and he ventures to offer the opinion that, during that long portion of time, few, if any, have witnessed a series of atmospheric phenomena so perplexing and anomalous. Another prefatory observation may be appropriately offered. The year 1847 proved so dry, that, by the table of the *Gardeners' Chronicle* the quantity of rain registered monthly

did not amount to more than 16¼ inches, and of this deficient total quantity nearly 6 inches fell during October, November, and December. In 1846 the tables gave 27¾ inches, of which 4·50 fell in August, and near 8¼ inches in the last quarter of the year. Both of these years suffered greatly by drought for nine months of each year; for although the severe thunder storms of August 1846 produced a heavy fall of rain, the previous aridity had not been compensated, and September was completely parched by solar heat and drought. Thus, then, in the southern counties, the balance had not been approached.

January 1848 came in with a slight morning frost; the day was sunny, wind at W. by N. It then veered to S.W. and S., and so continued till the end of the first week. The atmosphere was clear on the second; but subsequently it became quite overcast with clouds till the eleventh day—the weather chilly and very fickle, notwithstanding the great altitude of the barometer. Much rain fell on the 9th and 10th. Then the gloom passed away, and we had two or three sunny days. The temperature was soft, and even warm, till the 16th, averaging from 40° to 50° as a maximum. On the 16th slight frost recommenced, the wind being N.W. *Aurora borealis* at night, succeeded on the 17th by change of wind, total suffusion by cirro-stratus clouds, and showers fell. On the 18th the wind veered from W. to S.E.; the day was bright, but the evening became hazy, and a double parseline (lunar halo) surrounded the moon and the planet Jupiter. The phenomenon was beautiful, but threatening; cold, gloomy weather succeeded, and continued till the 26th—wind N.E., barometer rising to 30 inches plus. On that day the frost of the season was confirmed. It began on the 20th, (minimum 29°, maximum 30°, night at ten o'clock 30°,) —thence it acquired severity, till on the 28th the three periods registered gave 18°, 31°, 26°. The wind was in general very stirring, from N.E. to E; the sky was overcast, except on the mornings of the 27th and the 28th, when the sun shone brilliantly for a few hours, but the E. wind was very searching. Some trifle of snow fell on the 28th and 29th, but did not lie, for the wind went by E. to S. and S.W., and the thaw was established. Rain fell for several hours on the 30th, and again on the 31st, attended with sleet, after fog in the early morning. During the course of this first month our table registers fourteen days with falling weather, chiefly rain; but occasionally with hints of snow, which never lay on the ground. The wind was S. by W. on six days only; E. chiefly by N. on twenty days, and N. on the remaining five only. The average temperature of the thirty-one days—minimum 31° 5, maximum 38°, within a fraction. Thus the winter had passed with scarcely any frost.

In the year 1847, December had been severe throughout; and the young wheats were of so humble and stinted a growth as, in

many places, to be with difficulty discerned. Now, however, they were strong and verdant. The contrast was particularly striking, and should be borne in mind by those who study the effects of winter weather upon the young crops.

February commenced favourably: its two first days were fine, with an early frost of 2 degrees, speedily passing away—wind W. by N., changing at night to W. by S., a point of the compass from which it blew, with little deviation, till the sixteenth day. The rainy season commenced on the 3d, with much gloom; not any sun till the 9th. February is expected to be a dripping month, and its rains lay the foundation of that supply of ground moisture which is essential to spring developments. But when the preceding month has proved amply wet, and March, instead of bringing its expected drying winds, and frequent warm sunshine, proves consistently cold, and profusely rainy through the greater part of its course, the showers of February produce little benefit. The tenth day proved fine till sunset; then we had much rain. The eleventh and twelfth days were very fine—wind at W. and by N. The sixteenth also was fine, with similar concomitants, but the intervening days were moist and overcast. The *springs of water* continued to be very low. In our vicinity, where gravel constitutes the chief stratum, of about 14 to 16 feet in depth immediately below the thin superstratum of turfy, black mould, they are found in a porous bed of coarse, greenish sand, at about the depth of 45 to 50 feet. These springs frequently fail at the period of the shortest days, and seldom rise to any material height till March and April. It is, therefore, a general remark that the water of wells decreases with the decline of the day, and rises with its increase.

The 17th day was remarkable for the sudden rise of the barometer. At 10 o'clock of the preceding evening, my instrument marked 30 in. 0·4 cents—the wind had veered from W. to N.W. and N.; and at 8 o'clock on the following morning, (wind N.E.,) it had risen to 30·22, with light rime on the grass; and it continued to rise to 30 in. 45 cts.: and on the 18th, at 8 A.M., to 30 in. 46 cts.—sky overcast. The current then gradually changed to S.W., and by 10 P.M. the mercury had receded 20 cents.—air just frosty, or at 31°. The 19th dawned with a similar temperature—cloudy, with snow and sleet; barometer 29·91, to 29·76 cents. At this period, the finer weather terminated; and on the 20th the mercury had fallen to 29·50 cents. Feb. 21st—Barometer, average 29 in. 78 cents.; thermometer, 31°, 42°, 40°—frost, rapid thaw, small rain for several hours: henceforward we had no frost, the average temperature being about 45° 6—the wind S.W., with scarcely any variation of moment. 26th—Excessive fall of the barometer to 28 in. 75 cts.; but the mercury rose to 29·40, continuing to fluctuate to the close of the month, when, on the 29th, it fell

from 29·46 to 29·10. 29th—Beautiful forenoon; rapid formation of rain clouds—very wet evening. The average temperature of the whole month,—minimum at night, 38·82; maximum, 48·862.

So far, agriculture remained in a condition of prosperity. The rain of February had not been redundant; but the ground was now sufficiently moistened, almost to saturation. The drying winds of March were required, but the promise was not encouraging.

March came in with clouds and rain, and a low state of the barometer, which, in the preceding night, had fallen to 28 inches 90 cents: the two first days were partially wet; the 3d very fine, after much rain in the previous night: the barometer rose to 30·10 —wind N.E. 4th—One degree of frost, with rime; and this, with the 8th and 19th mornings, were the only three instances in which were any appearance of frost throughout the month; and clouds and rain, with few intermissions, prevailed till the 14th, which was a fine day—the wind N. for the first and only time. On the 11th we had hail-showers, sleet, fierce gusts of wind from W. by N., and two rolls of thunder. The 15th witnessed a sudden change of wind to the S.W., with much rain. The season began to be critical, because the vernal equinox approached: the wind was fickle—wavering between N.W. to S. by S.E., to E. on the 17th, 18th, and 19th: the 18th was fine and sunny. There was much fog and haze about this time, and a great deal of rain. The 19th dawned with mist and hoar frost, which passed away by noon; but then heavy clouds formed, bringing some showers, between which there were fine intervals that partially allowed the eclipse of the full moon to be observed. This eclipse began at London at 16 minutes after 7 in the evening: the total obscuration could not be seen by me; it occurred at 8 h. 21 m., and ceased at 10 h. 3 m. The reader must bear in mind that this phenomenon took place at the eve of the equinox. The sun passed from the sign Pisces on the 20th, at 16 minutes after 11 of the forenoon, and then entered the astronomical spring sign of Aries, (the Ram.) The wind had gone by S. to S.W.; the temperature was mild, and the weather showery, and very changeable throughout the three following days. A wet S.W. equinox has been proved by very long experience to be a sorrowful prognostic, and of this the S. and S.W. counties of England have now had convincing proof. 23d—A fine spring day—red sunset, followed by three gloomy days, with very little sun. From this time, (27th,) the mid-day temperature advanced progressively from 48° to 54°, 56°, 60°, but a good deal of rain fell. The wind inclined to an E. point, going from the W. by the N. to S.E., where it remained at the close of the month. On the 31st the barometer rose from 29·98 to 30·08; that is, $\frac{1}{10}$th of an inch: the weather became beautifully fine—my thermometer, at three periods, was read off at 46°, 70°, 56°. The average of the whole period was—37° 9,

minimum of the nights; 48°32 maximum of the days. Rain fell on twenty of the days: six only were fine and sunny; all the rest were characterised by gloom, occasional fogs, and suffusion of clouds. It was a melancholy period—unnatural in its progress, and lamentable in its prospects.

In thus closing the retrospect of the first quarter of the year, I may, relevantly, introduce a few lines of an agricultural letter received from a friend in Berkshire, as it conveyed a faithful picture of the then condition of the land and crops in the eastern part of that county, near the valley of the Thames.

> The month of March has been unpropitious for agricultural operations, as can well be imagined, and many a guinea would have been gladly given for a bushel of March dust; for during the last two months we have scarcely had two fine days together. Our rivers are still overflowing their banks; and where the land is undrained it is quite full of water, and but a poor chance has the unlucky occupier of getting in his spring crops. The wheat on wet soils looks very sickly, showing several dingy colours instead of its desirable dark-green hue: on dry, friable soils it continues to look healthy and strong. The season will be favourable to the advocates of thin sowing, as the plant has thrown out a great many tillers, and lies well on the ground, presenting a very different appearance from what it did two years ago, when it scarcely tillered at all.

I know the heavy, binding land of east Berkshire, and can well believe the statements of a party so experienced; but in justice to our agriculture here, where the earth is generally of a more light and friable temperament, I must say that the crops were, at this period, looking remarkably well. The great and prevailing cause of complaint consisted in the impossibility of preparing the land for spring seeding. At and about Croydon there exists a curious boundary line, which separates three species of subsoil: to the north, beyond the line of the Croydon Railway, the London clay abounds; toward the E. we have a vast bed of gravel—so extensive as to furnish the ballast for all the local railway lines, and the high roads, to a very considerable distance; while on the W. and S. toward Epsom, Godstone, and other localities, chalk is found at no great depth, and the gravel disappears. Over these dry substrata the ground is soon brought into a condition favourable for the plough, and here the turn-wrest is very commonly used. For miles, however, toward the N.E.—the close, binding loams, resting upon clay—the furrows retained the waters, the wheat appeared starved and thin, and it was found impossible to do any work. A brighter prospect appeared to dawn with that fine weather which burst upon us suddenly on the last day of March.

The advent of *April* brightened the prospect; the four days were perfectly beautiful and summer like. Wind N.E. on the 1st and 2d—gentle. Barometer 30 inches, average temperature early, 46°, maximum about 2 o'clock P.M. 70° and 72°—in the sun 94°. The wind went by S.E. to S.W. on the 3d; and to N.W. on the 4th; with the barometer rising 30·04 and 30·12. Ther-

mometer, 47°, 48°, 50°, 57°, at 10 P.M.—95 in the full sun. The new moon of the 3d might have somewhat influenced the weather, as on the 5th there was a sensible change: the mercury in both instruments went down, the wind fluctuated, and settled in the N.E. during the night preceding the 6th day, when the rainy weather recommenced. Henceforward the thermometer never rose beyond 55°, or *temperate*, excepting on three occasions—viz. the 12th, 56°; 17th, 57°; and 19th, 58° maximum. Cold rain fell on the 8th, 9th, and 10th,—and some snow on the last of those days.

Great activity prevailed during the sunny weather: the ploughs became busy, and large breadths of barley were sown. Some Chevalier barley, that had been in the ground from mid-November, advanced with great rapidity, and presented a fine prospect of luxuriance; but this partial visitation of summer sun, though it might make up for some lost time, was not propitious, — it acted too suddenly: the ground began to crack in fissures, and it was seen that showers would very soon be desirable. Showers *did* in effect come; but they bore no genial character: they were the concomitants of gloom, an atmosphere generally suffused with clouds during twenty-one days. The sun shone for a few hours, on the 11th, 26th, and 28th—the 14th day was entirely fine —and thus was marred the important month of April. From this date to the 19th (the wind being S.) the weather was very showery; on the 20th it shifted to N., varying only a few points, yet gloom and rain continued during seven days; and here I ought to allude to the following circumstance, which, if not of *general*, was constantly of frequent occurrence, and to such a degree as to be strikingly characteristic. *The N.E. wind rarely failed to produce rain!* In ordinary seasons, it was natural to expect six weeks of dry weather, under the influence of that wind; but in this anomalous spring, our table registers only about nine days of it between the 3d of March and the 26th of April, inclusive. On the 27th of the latter month, another remarkable change occurred: with the wind at S.S.W., the barometer at 30 inches, the sky began to clear; the morning was bright, the grass white with rime, (31°.) The wind, however, was variable, and the weather changeable; but it and the temperature improved, and the two last days became very fine. The averages of the month were,— night minimum 41° 4, maximum 54° 4. The *oak* trees were now in leaf and flower—generally much in *advance of the ash.* I mention this now, to correct an opinion which, of late years, had prevailed. With us, in the southern counties, this phenomenon failed, as a prognostic of a fine summer; but I was informed by a letter from Dalkeith, that *there* the two trees appeared to progress with equal steps.

May presented a phenomenon throughout. The barometer was very high, without interruption, from the 29th of April to the

evening of the 15th; the maximum being 30 in. 39 cents, on the 11th of May—the lowest mark being 30 in. 05·05 on the 29th of April, when the great rise commenced. On the 15th the mercury receded, and during five consecutive days it ranged between 29·54 and 29·97. Wind, S.W., the moon at full; on the 18th, at 6 h. 42 m. of the morning; a change of wind to N.W, on the 20th afternoon, raised the mercury to 30 in. 22 cents.; and it continued above 30 in. till the evening of the 31st, when a rapid fall commenced. A cloudless sun had blazed upon the earth till the 18th, when a change occurred, and a very little rain fell occasionally, during the prevalence of the S.W. wind. From the 22d morning, after haze, the weather resumed its fine character, and this it maintained till the afternoon of the 31st, when we had a shower with brisk wind from W.S.W. On the 18th and 20th there was some distant thunder during the changeable weather, induced by the S.W. wind; but its effects were transitory. The thermometer rose to 110° in the sun on the 6th, and to 107° on the 7th and 8th. On these occasions, the maximums in the shade were 68° and 72°; on the 14th, in the shade, at 73°, the full sun at 2 p.m. raised the mercury only to 100°—so uncertain and arbitrary are the indications of solar power marked by our imperfect thermometers. About the 7th day, the oaks were decidedly more forward than the ash trees; all the agricultural crops, when compared with those of 1847, were greatly in advance. Here, however, our favourable report must close, for with May — the only fine and dry month of the season — we bade farewell to anything resembling summer weather. But the month itself, with all its gorgeous accompaniments, was not found to be genial or benign. Crops were scorched on the ground, stiff land cracked in fissures, the hay-grass dried away at bottom, and fruit-tree blossoms were, in numberless instances, rendered abortive. We welcomed the splendour of the month, because the ground had been deluged with water; but we overlooked the disastrous consequences which must result from contrasts so violent and sudden. The average temperatures, minimum and maximum, were 48°·26 and 68°.

June.—On the 1st day the wind blew lively from the W., the moon new at 2 h. 40 m. in the afternoon; the temperature was reduced to 58° at its highest mark, and rain clouds formed. After a long period of drought, a few showers must certainly be propitious—and they approached; but so did the hay-harvest upon the forward pastures. The barometer fluctuated, averaging some tenths of an inch below 30 inches, so long as the wind was S.W. On the 12th the current raised, and we had thunder for two hours. At this period wheat came into its first stage of flower; autumn-sown barley (of which there were fine specimens) had been more than a week in full ear. *That* sown in April and May was very backward, as a natural consequence of the past unbenign seasons.

Here I would observe, upon the very important question of autumn-sown *Chevalier* barley—that, after the severe and long-protracted winter of 1846-7, the crops under my observation became superb in the spring, and at harvest time greatly surpassed those of 1848, which had had no winter to contend with. We now have had recent proof that growth may be retarded by severe weather during five consecutive months, (as in 1847,) without any corresponding loss of time; and furthermore, with the final compensation of ample crops, stored in the finest condition. As the converse of this consolatory fact, the mild winter of 1847-8, and the rich, verdant state of the wheat plant, so far from affording any pledge of abundance, did but prepare it for that serious and irreparable injury which it sustained from the unnatural rains of the month of March.

The *full moon* of the 16th, at 8 h. 58 m. evening, followed one of the fine sunny days of June. The 21st, or longest day—the sun entering Cancer—was really fine, as was also the 22d. The temperature advanced to 70° and 71°. From the 19th to 22d the barometer stood above 30 inches, and this short period comprised all the essentials of a fine June that this fickle season was permitted to afford to our southern counties.

On the 22d the barometer began to fall, the temperature diminished, the sun was early seen, and scarcely one day was without rain. The last day was promising till the evening, when a change occurred,—heavy, dark masses then formed, which were magnificently gilded by the setting sun. I may be permitted to observe that, if, after a rainy commencement, the weather becomes dry and warmer about the turn of the days, the summer will generally be fine. Such at least is the case in South Britain. On the contrary, if low temperature continue, and rain set in after the 24th, July will probably assume its wettest character. The average temperature of all the nights was 52°2. The average maximum, 66°5.

July.—The three first days were wet and cold; much hay, exposed to eight days' wet weather, had received damage. The 4th, 5th, and 6th were fine, and the heat at mid-day rose from 64° to 78° and 79°—wind N.E. and S.E. The next day was pretty fine, to which succeeded cold and wet weather. On the 8th at sunset, the N.W. horizon was illuminated in the most gorgeous style imaginable. Rich stripes of gold were intersected by spaces of a sea-green tint, while a flood of yellow light was poured forth, that produced (upon the trees particularly) an effect that words must fail to describe. These illuminations, with green strata interposed, are however certain indications of wet weather; and the month of July confirmed the fact by the occasional recurrence of such beautiful phenomena.

Hope revived under the influence of the four fine and sunny days which succeeded the moon's first quarter on the 10th morn-

ing. At this time, also, the wind was E. The baromete gradually risen from 29 in. 97 cts., to 30 in. 42 cts. Th however, came on at sunset of the 14th, after a hot oppressiv with wind fluctuating and variable in force. Rain followe wind being then N.E.; yet the weather, though disturbed, not be complained of, as the mercury was high in both instru and the sun was powerful, till on the 19th the wind went to and brought a great reduction of temperature, with a total sion of clouds.

At this date, we bade farewell to the maturing prospe summer; as, with the exception of the 22d, 27th, 28th, and all the remaining days of July were more or less rainy. were cut on the 23d, the farmers being led on by the tran fine gleams of two consecutive days. Cirro-stratus and gray clouds now became certain indicators of the very chan state of the weather. A great deal of rain fell prior to the when a little wheat was cut. This corn could not be house ing three rather sunny days; because, on the 30th, rain cam the full moon, and the month terminated with much rain c previous night, succeeded by showers, and alternating gleams on the 31st. The average temperature of the mont with me, minimum 55·22., maximum 69·22.

August.—1st day, the anniversary of the awful temp thunder, rain, and hail, which desolated London, and its so suburbs in particular, in 1846. My diary of this day contai following line, "Three showers—gleams before one P.M.,— *thunder* and rain, with hail at two P.M." The coincidenc striking, although the destruction by the hail was compar insignificant. On the present occasion, however, the prosp the harvest were far more overcast with gloom; for althoug had not been extensively reaped, yet, as so much rain had a fallen, the profuse showers that followed this war of the ele without the intermission of one fine day till the 1st, caused a ral cessation of field labour as the inevitable consequence. A set of the 2d, the western horizon was suffused with a lu glare; and thunder, accompanied with heavy rain, recurred 3d. After a fine day on the 9th, there were alternation again much thunder, with hail and heavy rain, on the 10th ing: from that date to the 15th, haze, or a sky generally ov and occasional close showers. The wheat harvest had become general after the 10th; but as there had been only four sunn in all, not any could be carried. One remark of serious i now suggests itself. It has of late years been admitted, that should be cut before the plant is completely matured; an certain that more flour is obtained from grain which h acquired that tough and horny texture which results from ripeness. But we are often instructed by wisdom to pref

lesser of two evils. Now, when wheat ripens, while its roots remain in the ground, the mischief just alluded to inevitably recurs. On the contrary, if it be reaped in that slightly immature state which will secure the perfection of the meal, it must be left in the field to become air-dried. In dry summers like those of 1842-4-6 and 7, these conditions are by nature fulfilled; and the farmer may remain quiescent without cause of hurry or anxiety. But in showery, or decidedly wet seasons, the only rule that can be adopted with any promise of security is, to "make hay while the sun shines." Keeping this rule in view, I adduce a fact which I have made it my personal affair to investigate with equal interest and attention. One of our principal farmers, who resides within three miles of Croydon, had above 20 acres of wheat growing in one connected plot, in the most beautiful condition, at the end of July. It then was in state to be cut, according to received modern practice; but, the weather being wet or extremely changeable, it was resolved to leave the wheat to obtain perfect maturity, and then to reap it in detail, and carry the sheaves to rick before sunset. There were two or three fine days in the early part of August —the labourers of the farm were collected in full force, under the immediate guidance of the able and experienced bailiff. The work proceeded in the order suggested, and before nightfall of each favourable day, a rick-cloth secured the sheaves that had been carried. Four days were required to clear the field, but on the fourth a shower fell on the sheaves which would have occupied two or three waggons. No damage, however, was sustained, as an opportunity occurred in a day or two to complete the in-gathering. I inspected the two ricks so formed, and had some of the corn drawn by hand; a finer and brighter specimen of wheat I never saw. Opposed to this most gratifying result, stands another of a very different character. The 10th of August was beautifully fine and warm till after 3 o'clock P.M. I saw great breadths of wheat in progress, in sheaf, and being reaped. A protracted thunderstorm, with prodigious rain, came on at 5 o'clock. The sheaves were soaked, and further progress was arrested. Fine weather, for two consecutive days, did not recur till the close; and scarcely any of this corn was carried for more than a fortnight. Are we not, then, justified in asserting that the rule of harvesting should be made to conform with the character of the then existing weather?

The 14th, very rainy; 15th, no rain—variable wind—two currents,—generally overcast; 20th, sunny, but again a change—air very drying; 21st, heavy showers, and forcible wind; 23d, generally fine — maximum temperature 66° — lightning; 24th, showers — finer afternoon, more lightning in the E.; 28th, oppressive—gorgeous sunset, richly tinged cirro-stratus: this splendid manifestation had occurred several times in the summer, but generally with the threatening concomitant of spaces tinged

with green — maximum 71°; 31st, fine till 4 P.M., then severe thunder for hours, with close rain. Average temperature of the month, minimum 53°, maximum 66°. The prevailing wind, (frequently very active,) was but fluctuating; it rarely approached the N. or E. A more perplexing month has seldom been recorded within my long experience; and a great deal of damp and sprouting wheat was harvested.

September.—A great and consequential change now took place: the thunder storm had balanced the electricity, and this ninth month ushered in the autumn with every auspicious omen. The barometer had risen to 30 in. 18 cents.; and wind became N.W.; the night temperature about 54°, that of the day 66°. The four first days were beautifully fine and sunny; but the evening of the fourth was rendered suspicious by one of those illuminations and gorgeous tintings at sunset, where the rich golden yellow was relieved by streaks of a pea-green hue. Field labour became active, and considerable breadths of land were cleared. On the 5th and 6th the barometer fell below 30 inches,—the wind fluctuated between S.E., W.N.W., and S.W., the moon passing her first quarter on the 5th. A few clouds formed, but the weather was little disturbed, and retained its fine character, with little interruption, till the day of the autumnal equinox, Sept. 22, "on which day, at 10 h. 18 m. P.M. the sun entered the sign Libra." All the days, from the 14th to the 23d, were bright and serene. The barometric column was below 30 inches on the 5th and 6th, 10th and 11th, and again on the evening of the 20th. It stood above 30 inches on all the other days, and became very high between the 11th and 19th. Those farmers whose patience had prevailed over their fears, succeeded in harvesting their wheat and barley in a very favourable condition.

The wind, which till the 20th had blown chiefly between S.W. and N.W., then went back to the S., thence, on the 22d (*the equinox*) to E.S.E., with a falling barometer. The day was fine, sunny, highest temperature 70°. Change of weather was indicated; and, on the 23d the sky became overcast, and there were showers. The wind again went back to S.E. on the 24th, which dawned with a dense, soaking haze. The sun, however, dispersed it for a time; but we had no more settled weather to the end of the month. If the equinoxes furnish trustworthy prognostics of the coming weather, that of the 22d of September will perhaps be received as the index of a mild, showery winter, with a low fluctuating barometer, and a prevalence of winds. The average temperature of the month ranged rather high, minimum 49° 6′, maximum 64° 7′. One slight frost, or rather rime on the grass, was noticed on the 13th morning.

October.—The weather continued to be cloudy and moist, the temperature rather warm, and the barometer 3 or 4 tenths below

30 inches, till the fourth evening, when the mercury rose above 30 inches, and so remained till the ninth day. These five days proved the fine period of the month, as the atmosphere was exceedingly fine—the air balmy, and even warm, with a fair proportion of bright sun. The wind was W.; on the 10th it changed to N., then, on 11th, to N.W.; the temperature reduced from 72° to 58°. Here the fine weather left us. On the 13th the current was N.E., and so it continued, with fluctuation, till the 21st. This was again a season of clouds, gloom, and cold rain. Floods rose and prevailed, of which the public press furnished lamentable accounts. About the 16th the temperature became very low: my diary states, '18th, 36°, maximum 42°; 19th, 37°, maximum 48°; 20th 42°, maximum 46°; rain profuse in the preceding night, and most of the day." A more gloomy, wet, and depressing season has seldom been witnessed: the ground was swamped, and the operations on the land suspended. On the 21st the wind became W., and the clouds began to pack into masses. The 22d evening was noticeable on account of the number of meteors, small and large, which passed between the clouds. To these succeeded beautiful alternate flashes of pale rose and primrose tintings. They proved to be indicators of the profuse rain which fell during the greater part of the 23d. The 24th was fine till mid-day; then cirro-stratus, total suffusion, and rain. 25th, fierce N.W. wind—fine, changing to S.W., which produced brisk showers. 26th, wind S. by S.E.—much more sunny, with alternate shower-clouds; 27th, much wind and rain; 28th, sunny gleams—intervals of heavy rain; 29th, overcast — rainy evening; 30th, sunny gleams — rain, then a fine evening—much rain in the night; 31st, variable wind, N.W. to S.E.—fine day. These items will show the alarming condition of the weather at a period when the husbandman ought to have safely deposited his seed-wheat. Anxiety kept pace with the accounts of increasing floods; but it was mercifully decreed to pass away.

The chief meteorological phenomena of the month consisted of a prevailing low state of the barometer, much below 30 inches. Wind S. and by W. on 13 days; N. and by W. 8 days; E. by N. or S. 8 days; W. on the 4th and 21st days. Average temperature, minimum, 45°5; maximum, 55°53.

November came in true to its character, the first day being foggy and hazy throughout; barometer low, 29·51, but rising; temperature, 37° 46°, wind E.N.E. 2d, a very fine and drying day, wind W., as also on the 3d. From the 7th to the 10th inclusive, the mornings were rather frosty, the days fine, temperature about 45°, wind N.W. to N.E., barometer rising to 30 in. 30 cts. This change of weather was very favourable to agriculture; the plough became very busy, and great breadths of land were sown; the floods passed away, and prospects improved. Many plots of

potatoes were dug and stored in far superior condition to what could have been anticipated, judging from the early and complete destruction of the haulm. After the 10th, fog, clouds, and atmospheric moisture, till the 14th proved that there was much electric disturbance, although the mercury continued very high. The barometer fell rapidly during and after the night of the 16th from 30 in. 27 cts. to 29·88 on the 17th evening, when the heavens displayed that glorious *aurora borealis*, which was noticed so particularly in the newspapers of the northern counties. There were two manifestations of this grand electro-magnetic phenomena within a few nights of each other, one of which I unfortunately did not observe. The following remarks will, however, convey a pretty correct idea of the one I witnessed:—The aurora first illuminated the western quarter of the heavens; the effect produced was the suffusion of a pale lemon-tinted blush, which illuminated every object, and rendered the trees and houses everywhere mysteriously visible. From this mass of light, which appeared to evaporate, as it were, from the luminous edges of the clouds themselves—corruscations darted toward the zenith, varied by streams of a faint crimson colour. The wind blew fresh from W., and the sky became partially clear at times; it then became more overcast, yet here and there a star was seen: the edges of the clouds appeared to dissolve in luminous vapour, yet their bases remained undisturbed: altogether, the phenomena were anomalous in many respects, if we can compare the reports from Yorkshire, Derby, and Liverpool, now before me, with one's own experience of the present and many past years. Whatever may be great agents of aurora, the immediate effects appear to have been a complete break-up of the fine weather. The wind became S.W., and remained in that quarter to the end of November, with few deviations. The barometer fell and fluctuated repeatedly between 30 inches and 29 in. 20 cts., the fall generally occurring in the afternoon. A great deal of rain came in the course of the week, but the weather improved again on the 24th. On the 25th there were rime and 2° of frost; of course rain came on in the evening, and much fell in the night, and again in that between the 26th and 27th. To the end of the month the sky was much overcast, yet there was considerable improvement. The average minimum of the nights I estimate at 37° 4′; the maximum by day 47°.

December came in with wind at S.W., forcible at night, entirely cloudy, mild, barometer falling. The 3d morning marked 32° fah., or 1° of frost; but this went off in an hour or two with a wind at S.W., in which quarter it remained, with trifling variations, till the end of the 14th. The temperature became very mild, and, till the 8th inclusive, much rain fell. In the evening a great change commenced, the particulars of which are worthy of some attention. In the course of the 8th, the barometer

rose from 29·80 to 30 inches—wind lively. On the 9th the average of the mercury was 30 in. 19 cts.; thermometer 42° to 54°, 60° in the sun, wind fresh, becoming calm after sunset—weather fine and spring-like; 13th, barometer receded to 30 inches, maximum heat 55°, quite fine; 14th, the fine, balmy weather began to give warning of a change, by the S.W. wind becoming fresh, and the progressive accumulation of rain clouds.

Then we arrived at a state of transition: the rain had passed away: the wind settled in the E., varying only about a point by the S. or the N.; the temperature was reduced a degree or two, and the sun did not disdain to shine. The 19th and 20th days were, however, cloudy, yet the glass rose to above 30 inches, and the thermometer at 10 P.M., marked 31°, 1° of frost. The 21st, or shortest day, so-called, on which the sun enters Capricorn, and begins to ascend in his course, dawned without a cloud, frosty at 27°; the wind blew fresh from the E. by N., and the barometer stood at 30 in. 30 cts. Frost continued till the night of Christmas Eve. The 22d, morning temperature 28°, maximum 39°, at 10 P.M. 29°; barometer 30.30 cts., wind E. by N. brisk, atmosphere splendid; 25th, some rain early, complete thaw, barometer 29.80, rising to 30.2, maximum temperature 45°; 30th, some rain, finer intervals, wind N.E., average temperature of the last three days about 42°. The E. wind announced frost, and as the barometer remained steady at 30.10 cts., the New Year may commence with cold bracing weather. The average temperature of December may be quoted at 42° 7.

I thus bring my characteristics of the year 1848 to a close: it has been a notable and extraordinary period, not only as refers to its meteorological phenomena, but also in the awful revolutions which have convulsed the greater portions of Europe. We are not permitted to foresee results; but assuredly "the end is not yet." In an agricultural point of view, I hope we may console ourselves by the belief, that the extreme drought of the year 1847 being now balanced by the redundant rains of 1848, we may reasonably anticipate a *seasonable* year, propitious to the land at all the different periods devoted to the operations of spring, summer, and autumn.

The Law of the Nutrition of Animals, pointed out by Dr R. D. THOMSON, illustrated by F. KNAPP, Ph. D., Professor of Technology and Chemistry in the University of Giessen.*—On the farm of Boussingault at Bechelbronn, in order to ascertain the quantity of milk produced, seven cows were subjected to an accurate series of experiments extending over a whole year. They received daily 30 pounds of hay, or of those roots similar in com-

* From the London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science for June 1848.

position, and yielded together 8788 maass (3837 quarts). The time during which they supplied milk was 302½ days. This gives as a mean 4·1 maass (1·8 qt.) daily for each cow. But the quantity of milk varies very much; for in the months of July and August they yielded above 6 maass, (2·64 qts.,) while in February and March they gave only about 2½ maass, (1·1 qt.) From observations of a similar nature, made however upon only one cow, the average daily quantity of milk yielded was 3·7 maass, (1·63 qt.) If we take 2½ maass (1·097 qt.,) as the lowest quantity, and 7 maass (3·073 qts.) as the highest, we get daily, for one cow, from 10·3 lbs. to 29 lbs. of milk, which contain—

	4·69 oz.	troy to	13·04 oz. butter.
	7·08	—	20·02 oz. sugar of milk and soluble salts.
	7·88	—	22·18 oz. casein and insoluble salts.
Total	19·65		55·24 oz. solid matter.

In reference to the influence which the food has upon the quantity of milk, all farmers know that cows give most milk with green food, and less with hay, &c. In other respects the influence of the food is not so great as might be expected.

Boussingault and Le Bel agree upon this point, at least so far as concerns the quantity of milk.* Dr R. D. Thomson, on the contrary, draws from similar and equally extensive experiments the conclusion, that the quantity of milk and butter increases in proportion to the quantity of nitrogen (contained in the plastic matter) of the food. He has drawn this conclusion from experiments upon two cows, during periods of five days. His results are shown in the following table, in which grass is the only exception.†

Kind of food.	Pounds of milk.	Pounds of butter.	Nitrogen in the food in 5 days, in lbs.
Grass	114	3·50	2·32
Barley and hay	107	3·43	3·89
Malt and hay	102	3·20	3·34
Barley, molasses, and hay ...	107‡	3·44	3·82
Barley, linseed, and hay ...	108	3·48	4·14
Beans and hay...	108	3·72	5·27

Another table gives the average quantity of solid constituents of the milk for periods of five days:

* Boussingault has recently found that hay is equally efficacious with grass in producing milk and muscle,—a result which is certainly not applicable to hay made in usual seasons in this country.—Tr.

† Dr Thomson attributes the superiority of grass to the proper balance of the proximate principles, which in hay and grain is much altered by the drying process.—Tr.

‡ In Dr Knapp's work, the number taken from the original is 106. The present number has been recalculated from the original data.—Tr.

	KIND OF FOOD.							
	Grass.	Barley entire.	Malt entire.	Barley crushed.	Malt crushed.	Barley and Molasses.	Barley and Linseed.	Beans.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Milk	29·64	25·57	24·82	28·12	26·61	26·96*	27·48	27·00
Butter	5·96	5·56	6·56	6·87	6·43	7·00	7·00	7·05

The milk consists of—water, 87·19; butter, 3·70; sugar, 4·35; casein, 4·16; soluble salts, 0·15; insoluble salts, 0·44. The constituents of the butter are oil, 86·3; casein, 0·9; water, 12·8.

The fact that not merely the quantity of milk but also that of the butter increases with the amount of nitrogenous matter in the food, (that is, with the proportion of plastic nourishment,) is worthy of notice; for, from the absence of nitrogen in the butter, we should be apt to expect the contrary. Playfair, in his experiments, has certainly inferred this; for according to him, those substances which do not contain nitrogen, (potatoes, &c.,) yield milk rich in butter, and rest (stall-feeding) acts in the same way; while, if the animal be allowed to feed on poor pasture, where it must move about a good deal, it yields milk rich in casein. But his experiments are continued for such short periods, that important conclusions cannot be deduced from them. From Dr Thomson's observations, we find that, if a cow always receives the same kind of food, the quantity of milk gradually decreases; but if its diet be changed, it rapidly increases. A frequent change of diet is therefore advantageous. He has also established the rule, that the quantity of milk obtained from a cow is greater in the morning than in the evening.

When fed on barley and hay, they yielded—

	Aug. 1.	Aug. 2.	Aug. 3.	Aug. 3.
Morning, .	$11\frac{1}{8}$ lbs.	$11\frac{1}{8}$ lbs.	$10\frac{10}{16}$ lbs.	$10\frac{14}{16}$ lbs.
Evening, .	$10\frac{1}{5}$	$9\frac{11}{16}$	$9\frac{11}{16}$	$9\frac{11}{16}$

The following observations of Dr Knapp are founded on a table given by Dr Thomson, deduced from his own experiments, in which the relation between the nutritive and calorifiant matter is stated for different kinds of food.

	Relation of nutritive to calorifiant matter.
Cow's milk—food for a growing animal, .	1 to 2
Human milk, ...	1 — $2\frac{1}{2}$
Beans, ...	1 — 6
Oatmeal, ...	1 — 5
Semolina, Barley, ...	1 — 7
English wheat flour—food for an animal at rest,	1 — 8
Potatoes, ...	1 — 9
Rice, ...	1 — 10

Continued.

* This number is 25·69 in the original German, but has been recalculated from the English data.—Tr.

	Relation of nutritive to calorifiant matter.
Turnips,	1 — 11
Arrow-root, Tapioca, Sago,	1 — 26
Starch,	1 — 40 *

From this table it appears, that an animal taking exercise should be supplied with food formed upon the same principles as the first-mentioned six; and that, in proportion to the exertion, the closer should be the relation between the ingredients.—Tr.

In order to judge of the values of different kinds of food for practical purposes, it must first be ascertained in what relation the blood-forming or nutritive constituents stand to the calorifiant. The kind of food must also vary with age, kind of employment, way of living, climate, &c. With the highest probability we may predicate, that a man in an employment demanding great mental activity will require, in addition to a greater proportional amount of bodily rest, that the calorifiant and blood-forming constituents should be in a different proportion in the food, to that of the man whose employment requires great bodily activity.

Thomson has traced out a very simple and ingenious method of supplying this defect in our knowledge. He ascertains the weight and composition of the food given in a certain time, as also that of the excrement thrown out. From both factors he is enabled to calculate the quantity of food assimilated, as also the relation of the calorifiant to the blood-forming constituents. He found that a cow, stall-fed, assimilated daily 15·28 lbs. of rye-grass, which contained 1·36 lbs. of blood-forming and 13·00 lbs. of calorifiant matter. They thus stand in the relation of 1 to 8⅓—a proportion which, it is highly probable, is much more nearly related in man, as the relation in the various kind of farinaceous food is about 1 to 5 or 1 to 6. We know with certainty, that in the infant the relation, as in milk, must be 1 to 2½.

A company of soldiers were fed on flesh, bread, vegetables, legumes, beer, brandy, fat, &c.; and from the experiments made on these by Liebig, the relation of the blood-forming to the calorifiant matter in the food may be accurately determined. By ascertaining the amount of food taken and the excrement thrown out, the quantity of food assimilated may be determined, as also the above-mentioned relation. In this manner the following results were obtained:—

		Water.	Solid matter.	Relation of the blood-forming to the calorifiant matter with solids.
Pounds of food consumed,	4001	1655	2346	298 : 1357
Pounds of excrement,	294	220½	73½	13 : 51
Relation of the blood-forming to the calorifiant matter in the food assimilated,				285 : 1306 = 1 : 4·7

* Thomson on the Food of Animals, p. 167.

As this number 4·7 is calculated from experiments made on ersons who undergo considerable bodily exercise, it will increase* ı those whose employment is sedentary. Although these numbers re not absolutely correct, some important conclusions may be rawn from them.

It is evident that the relation 1 to 4·7 is almost exactly that rhich exists naturally in the various kinds of grain. Those bararous nations which live entirely on flesh receive a large excess f blood-forming matter, which may be counterbalanced either by he addition of calorifiant matter, or by increased bodily exercise.)n the contrary, the poorer classes amongst us are obliged to ive on the cheapest food they can obtain, such as potatoes, &c.,† vhich are one half poorer in blood-forming or nutritive matter than he different kinds of grain. In the first case nature has only to ;et rid of an excess; but in the latter she has to supply a deficiency, vhich must be done by bread, milk, &c. It must be evident to ›very one that this way of living is unnatural in the extreme. A)erson living entirely on potatoes may be said to be on the brink)f a precipice without a single inch of ground before him, where :he only safety lies in retreat. Its disadvantages may be shown .n three different ways:—1st. It leads to imperfect bodily strength ınd unsoundness of health. 2d. To increased mortality and ›hortness of life. 3d. To loss of energy, and to a kind of stupidity ınd want of interest in everything but what concerns the merest animal interests. A country in this state is always ripe for rebellion, and ready to join in every insurrection.

From the above remarks, it would appear that the manufacture)f brandy from potatoes is a separation of the excess of calorifiant natter, whilst the residue contains all the blood-forming constituents. [t is mixed with the gluten of the malt, and thus forms a half-soluble food. In order, however, that it may suit the nature of ruminating animals, straw or some such food should be added to it. As potatoes contain about one part of albumen for ten of starch, the half of the starch may be converted into spirit, while the remainder will consist of a mixture having the nutritive and calorifiant constituents in the same proportion as in grain—1 : 5.

The Plant; a Biography. By SCHLEIDEN. Translated by

* The word in the original is "vermindern;" but in the present case it is obvious that the author means the reverse of diminution.

† "The previous views," says Dr Thomson, (on Food, p. 173), "sufficiently explain the experiments which have been made upon cows, in which the result was unfavourable when they were fed on potatoes and beetroot in considerable quantities, as both of these substances contain an excess of calorifiant matter. It is well known to feeders of cattle that an animal fed on large quantities of potatoes is liable to such complaints as affections of the skin, and also to loss of weight." These consequently, it may be readily inferred, arise from the want of the proper balance between the elements of the food.—TR.

Henfrey.—Perhaps the more proper title for this singular book would have been a *Rhapsody* rather than a *Biography*. Its author is one of the most celebrated botanists of the present day, and has very candidly admitted his motive for publishing to be "class vanity." A large portion of the uninitiated, even among the educated classes, are still in the habit of regarding the botanist as a dealer in barbarous Latin names—a man who plucks flowers, names them, dries them, packs them up in papers, and whose whole wisdom is expended in the determination and classification of this ingeniously-collected hay! It is with a wish that a better opinion of the botanist might be formed that this book has been published.

The work is illustrated with some very good wood-engravings and coloured prints, which certainly help in a very considerable degree to render the more tedious descriptions interesting.

As best suited to this Journal, we shall confine our remarks to those chapters on "What does man live upon?" One of these is headed by the following singular quotation from Faust:—

> Dust shall he eat, and gladly,
> As does my cousin, the renowned Serpent;

and it certainly gives no bad idea of the style of the book. We must find room for an anecdote with which he has introduced one of his lectures, evidently showing the tact of a man who can catch the attention of his audience. He says, at one of the larger lunatic asylums he found a patient crouching down by the stove, watching with close attention a saucepan, the contents of which he was carefully stirring. "At the noise of my entrance he whispered, 'Hush, hush! don't disturb my little pigs—they will be ready directly. You see here I have black puddings, pigs' bones and bristles, in the saucepan—everything that is necessary: we only want the vital warmth, and the young pig will be ready-made again.'" It is with such stories as the above, at the commencement of the lectures, that the author has endeavoured to rivet the attention to the most abstruse matters.

In answer to the question—"What does man live upon?" our author quotes largely from Liebig, who certainly was the first to point out that bodies of precisely similar chemical composition existed both in the animal and vegetable world, and which are most probably transferred from the one to the other unaltered.* The whole of the substances used by man for food may be divided into two groups—1. Those containing nitrogen; 2. Those without nitrogen. The first are called the *materials for nutrition*, the second Liebig has very properly named *materials for respiration*. These are found combined in the cereals, and in milk. The first exists in the largest degree in animal flesh, and the latter in gum, sugar, starch, spirits, wine, beer, and, lastly, the various kinds of fat.

* See review of *Fresenius* in this Journal.

But perhaps the most singular facts connected with the question, "What does man live upon?" are those bearing upon tea and coffee, which are now amongst the necessaries of civilised life, as the Paraguay tea is to the South American. In all these substances chemistry has discovered *precisely the same substance.*

And, finally, chemistry has brought to light the fact that all those substances used by man as food are compounds of the four simple substances,—oxygen, carbon, hydrogen, and nitrogen.

In the second lecture on this subject, Schleiden alludes to the opinion just broached by Liebig, that the vegetable world lives upon the carbon, ammonia, and water of the atmosphere; and very properly asks, If this be the case, of what use is manure? Liebig's idea was, that it was to supply the mineral part of the plant alone, and that the farmer would get as much benefit if he burnt his manure-heap, and strewed the land with the ashes.

With this view, Liebig has recently sought to revolutionise our whole agricultural system, by the recommendation of a mineral manure he has discovered, for the preparation of which he has taken out a patent in England, and sold it to Messrs Muspratt and Co. His aim is to furnish to every soil and plant a proper compost of those mineral substances which the plant requires, and the soil is deficient in, and in such a peculiar state of combination, that the substances shall be soluble enough to be taken up by the plants, and yet not so readily soluble that the rain can wash away any considerable quantity.

Every farmer who has tried Liebig's manure is aware of its failure; and we think that this has been principally caused by his want of attention to the difference of climate between Germany and England. In the clear sunshine of the former it may be possible to dispense with ammonia in the manure, but certainly not in England or Scotland. We regret exceedingly that Liebig should have so publicly pledged himself to certain views, as we have no doubt but that his failure has damaged the cause of scientific agriculture, and thrown it back by several years.

Schleiden attributes the potato disease to persisting in growing the potato upon richly-manured land, and recommends that it should not be made, as now, a fallow crop, but come in after the wheat or clover. This is one of the many instances in which scientific men, leaving their proper sphere, involve themselves in error. Any farmer knows that, if grown as Schleiden recommends, our potato-crops would be quite as deficient as ever they can be from the disease, and, we think, would not afford any security against its ravages. For ourselves, we have no fear of the degeneration of the potato, and attribute the disease wholly to atmospheric influences, from which we shall certainly ultimately escape.

M. B.

Experiments with Special Manures on Grass. By Mr ALEXANDER ROSS, Land-Steward to George Cranstoun, Esq. of Corehouse, Lanarkshire.—The manures were top-dressed on young grass for hay on the 14th April; the grass was cut on the 3d July; and the hay weighed and stacked on the 15th July. The hay is valued at £3 per ton. Nature of the soil, light-brown loam. Exposure east. Elevation, about 700 feet above the sea:—

	Substances employed.	Application of the Special Manures.				Effects of the Special Manures.		Economical Result of the application of the Special Manures.		
		Quantity of Special Manures.	Cost of Ditto per Cwt.	Cost of Ditto per Acre.	Cost per Acre of the Special Manures mixed.	Produce of Hay per Acre.	Value of the Hay Crop.	Excess of Produce in Hay.	Value of the Excess of Hay.	Gain from Application.
		cwt. lb.	s. D.	s. D.	L. s. D.	cwt. lb.	L. s. D.	cwt. lb.	L. s. D.	L. s.
1	Nothing,					36 2	5 8 1			
2	Peruvian Guano,	1 56	11 0	16 6	0 16 6	56 63	8 6 6	19 51	2 18 5	2 1
3	Peruvian Guano,	1 0	11 0	11 0	0 19 6	63 37	9 9 9	27 35	4 1 4	3 1
	Animal Charcoal,	2 0	4 3	8 6						
4	Peruvian Guano,	1 0	11 0	11 0	0 18 9	54 27	8 2 4½	18 25	2 14 9	1 16
	Saldanha Bay Guano,	2 0	3 9	7 6						
5	Saldanha Bay Guano,	4 0	3 9	15 0	0 15 0	42 14	6 6 4½	6 12	0 18 3	0 3
6	Saldanha Bay Guano,	2 0	3 9	7 6	0 15 10	47 2	7 1 0	11 0	1 13 0	0 17
	Gypsum,	4 0	2 1	8 4						
7	Saldanha Bay Guano,	2 0	3 9	7 6	0 16 0	58 84	8 15 10	22 82	3 8 0	2 12
	Animal Charcoal,	2 0	4 3	8 6						
8	Animal Charcoal,	3 56	4 3	14 10½	0 14 10½	40 0	6 0 0	4 0	0 12 0	loss
9	Animal Charcoal,	2 0	4 3	8 6	0 14 9	44 37	6 12 9	8 35	1 5 0	0 10 3
	Gypsum,	3 0	2 1	6 3						
10	Gypsum,	7 0	2 1	14 7	0 14 7	41 14	6 3 4	5 12	0 15 4	0 0 9
11	Gypsum,	4 0	2 1	8 4	0 15 0	41 1	6 3 0	5 0	0 15 0	0 0 0
	Common Salt,	4 0	1 8	6 8						
12	Coal Ashes,	60 0	0 3	15 0	0 15 0	43 36	6 9 4	7 34	1 2 0	0 7 0
13	Turf Ashes,	60 0	0 3	15 0	0 15 0	40 3	6 0 1	4 1	0 12 0	loss
14	Common Salt,	9 0	1 8	15 0	0 15 0	39 7	5 17 2	3 5	0 9 2	loss
15	Turf Ashes,	40 0	0 3	10 0	0 15 10	54 83	8 3 10	18 81	2 16 0	2 2 0
	Liquid Manure,	140 0	0 0½	5 10						
16	Liquid Manure,	300 0	0 0½	12 6	0 12 6	49 38	7 7 4	13 36	2 0 0	1 7 6

Trial of several Varieties of Oats in 1848. By Mr HAY of Whiterigg, Roxburghshire.—For some years past it has been with me a question, when seed-time was drawing near, what kind of oats should be used, so that the largest quantity and best quality of grain with the greatest weight of straw might be obtained, and at the same time might ripen early; and, after having tried various kinds in succession, I made up my mind to try, in one field of uniform quality of soil, a few of those kinds which are most generally grown.

The kinds I made use of were the potato, Sheriff, Birley, Hopetoun, Blainslie, sandy, and Barbachla. The potato and Blainslie were obtained from Berwickshire, the Sheriff from East-Lothian, the sandy from Peebles-shire, the Hopetoun and Barbachla were grown in the district last year, and the Birley I had of my own.

In a district like this, where the climate is late, and the soil for the most part cold wet clay, and difficult to manage, unless by catches, it becomes the farmer to look out for that variety of grain which can be early harvested, and which also yields a large quantity and fine quality.

The field on which the oats were sown is of a stiff cold clay soil, with retentive subsoil, and was, about eight years ago, furrow-drained with stones $2\frac{1}{2}$ feet deep, and 24 feet apart, after which it was broken up from grass, a rotation taken, and again laid down in grass for three years, in each of which it was pastured with sheep and cattle. The lea was ploughed early in the autumn of last year, and sown in the beginning of April this spring.

The land was laid off in double ridges, with the drains in the furrows; and each parcel of oats was sown upon two of those double ridges, which made nearly an acre. The seed was all sown by one man, by the hand, and no regard paid to the difference of kind in quantity, he having a boll of 6 bushels of each at his command, that it might be known how far the different kinds went: the difference between them was not great, being from 5 to $5\frac{1}{2}$ bushels per acre.

As I kept notes of the time of sowing, progress made during the growth, &c., it will be as well to furnish them at this time, that a right estimate may be formed of the value of the respective oats.

The first four kinds were sown upon the 4th, the other three upon the 5th, of April; all got well in, the land being in a very dry state. They all brairded upon the 3d of May, the Birley being evidently then the best, and the Barbachla the worst; and scarcely any difference was perceptible among the others.

11th and *12th May*. Examined the braird, and found that the Birley oat still keeps the lead, but the Blainslie is almost equal to it; the potato, Sheriff, and Hopeton next; the sandy not so good, and the Barbachla the worst.

22d May. Carefully examined all the kinds, and find that the

first five are all strong, and nearly equal in the braird; but the sandy and Barbachla are far behind.

21st June. Find the Birley quite ahead of all the others; and the other four still in advance of the sandy and Barbachla.

11th July. Several of the kinds are pretty well shot out, the Birley still keeping the lead, the Sheriff next, then the potato and Hopetoun; the Blainslie not at all shot; and, in the sandy and Barbachla, but a few heads appearing.

21st July. Examined the oats again to-day, found all fully shot out, with the exception of the Blainslie, which is scarcely shot.

7th August. The Birley oat has begun to colour, is indeed much so, and still ahead; the Sheriff begun to change colour; the potato slightly; the Hopetoun, Blainslie, and Barbachla, yet quite green.

17th August. Examined the field with the view of seeing which of the kinds appears strongest on the ground, as well as farthest advanced, and find the Birley 1st as to ripeness, but 3d as to strength; the Sheriff, 2d and 4th; the potato, 3d and 2d; the Hopetoun, 4th and 1st; the Blainslie, 7th and 5th; the sandy, 5th and 7th; and the Barbachla, 6th and 6th.

1st Sept. The Birley oat was reaped this day, making a commencement of cutting the different kinds. The Sheriff and potato were cut the day following, the Hopetoun on the 4th, the sandy on the 7th, the Blainslie and Barbachla not until the 15th.

It will be seen by this statement that an entire fortnight intervened between the cutting of the first and the two last, which is a great advantage the Birley possesses over the others, more especially in a late district of country, when even a week is of the utmost consequence.

The sandy is more deficient than any of the others in bulk of straw and grain; and the weight of good grain per bushel is with the Sheriff, which stands second; while the Birley, yielding nearly as much bulk, gives less corn, but of the same weight as the potato, and fully as early and a surer crop, I am disposed to think. The Hopetoun and Blainslie are very much alike in point of both quantity and quality, but 11 days of earliness in favour of the Hopetoun would induce me to retain it, while I would reject the Blainslie. The Barbachla, again, does not seem to have anything to recommend it; for, with the same bulk of straw and grain as the Birley, it gives only half a bushel more corn, and is not only 3½ lbs. per bushel lighter, [illegible] days later of ripening.

[illegible] om the following Table that I have taken every particular into account, and placed the different kinds in the order of excellence in which they are numbered in the last column—thus, 1st, Hopetoun; 2d, potato; 3d, Sheriff; 4th, Birley; 5th, Blainslie; 6th, Barbachla; 7th, sandy.

TABLE OF RESULTS.

Names of Varieties of Oats.	Quantity sown, per imperial acre.	Weight, per bushel.	When sown.	When brairded.	When in ear—state of forwardness then.	State of kinds as to ripeness and strength.	When reaped.	Weight of produce of straw and grain from 96 sheaves.		When threshed and dressed.	Produce of marketable grain from the 96 sheaves.	Produce of light grain from the 96 sheaves.	Weight, per bushel, of marketable grain.		Priority as to bulk of grain and straw.	Priority of quantity, good and light corn.	Priority as to weight of good corn.	Priority, combining bulk with weight.	Priority as to earliness of ripening.	Priority, combining bulk with weight and earliness.
	Bush.	lbs.	April	May	July 11.	On Aug. 17.	Sept.	cwt.	qrs.	Sept.	Bush.	Bush.	st.	lbs.						
Hopetoun ...	5	42	4	3	4th.	4th and 1st.	2	7	0	28	6	$1\frac{1}{10}$	2	$10\frac{1}{2}$	2d.	2d.	3d.	1st.	3d.	1st.
Potato... ...	5	44	4	3	3d.	3d — 2d.	2	6	3	28	$6\frac{1}{2}$	$\frac{1}{2}$	3	0	3d.	3d.	1st.	2d.	2d.	2d.
Sheriff ...	$5\frac{1}{4}$	40	4	3	2d.	2d — 4th.	1	6	0	28	$6\frac{3}{4}$	$\frac{3}{4}$	2	13	5th.	1st.	2d.	3d.	2d.	3d.
Birley.. ...	5	40	4	3	1st.	1st — 3d.	4	6	1	28	$5\frac{1}{2}$	$\frac{1}{2}$	3	0	4th.	6th.	1st.	5th.	1st.	4th.
Blainslie ...	$5\frac{1}{2}$	40	5	3	7th.	7th — 5th.	15	7	1	28	6	$\frac{3}{4}$	2	9	1st.	4th.	5th.	4th.	5th.	5th.
Barbachla...	$5\frac{1}{4}$	...	5	3	6th.	6th — 6th.	7	6	1	28	6	$\frac{1}{2}$	2	$9\frac{1}{2}$	4th.	5th.	4th.	6th.	5th.	6th.
Sandy	$5\frac{1}{2}$	...	5	3	5th.	5th — 7th.	15	4	3	28	$4\frac{1}{2}$	$\frac{1}{2}$	2	13	6th.	7th.	2d.	7th.	4th.	7th.

The latter part of the experiment was conducted upon 96
that being about a cart-load—and these sheaves were tak
eight different parts of one ridge of each kind, so as
trial of the crop as equal as possible; and in this way,

dence may be placed upon the experiment, as if the whole crop from each part had been weighed and threshed. Besides, each variety was stacked by itself, and the kinds best suited for my purpose being intended for seed, it became necessary to keep the stacks entire until spring, and that only a sample should be tried.

It may be said that I am prejudiced in favour of the first four kinds, and of these four I have hitherto given the preference to the Birley,* the Hopetoun and potato being more precarious. The Sheriff I purpose continuing, as it is early, and will in all probability prove better the second year than the first; and, being new to me, it would be unfair not to give it another trial in this district. From previous trials, along with this one, the Birley will still remain a favourite oat; while the sandy, which I have been in the habit of growing for some years, I shall reject, as I have not found it productive either in straw or grain, but when the land was in very good order; and therefore, consider one of the other varieties would be more profitable. The Barbachla is a coarse oat, and more fitted for horse corn than anything else.

Immediate Arboreal effect in Landscape Improvement.†—" While you at Twick'nham plan the future wood," is the opening line of a poetical epistle addressed by the author of *Night Thoughts* to the translator of Homer. It is often the case, in metrical lines of ten syllables, that two of these are of a redundant nature, and could be omitted without impairing the sense of the passage in which they occur. Thus, it has been shown that many portions of the English translation of Homer's *Iliad* might be thrown into the rapidly flowing measure of the *Lady of the Lake*, merely by deleting two syllables from each line, and leaving the others untouched. In the poetry of Young there are comparatively few lines that could bear this sort of mutilation without injury; for each of that writer's words is massive and full of meaning, and has an allotted space on the page to fill, which could not well be left vacant. An example is readily furnished by the line above quoted. The only two syllables that it could at all spare are those which constitute the word *future*. But, lacking that word, the line, although readable as a mere harmonious assemblage of expressions and sounds, would lose considerably more than half its meaning, and, in the estimation of the thoughtful reader, the best key-note to a train of meditation which it contains; for the word *future* has here a magic

* When I was in Peeblesshire, last November, I saw a sample of Birley oats, the produce of seed which I sent there in spring, most beautifully fair, and weighing 8 st. 12 lb. per boll of 6 bushels.

† *The Planter's Guide: A Practical Essay on the Best Method of giving Immediate Effect to Wood by the Transplanting of Large Trees and Underwood.* By Sir Henry Steuart, Bart., LL.D., F.R.S.E., &c. Third Edition. With Memoir of the Author, and his last additions and improvements. William Blackwood & Sons, Edinburgh and London.

ct. It transforms a bare statement of an assumed fact into an ı, quietly and unobtrusively expressed, yet fitted at once to rest the mind in the supposed occupation of the person to whom epistle is addressed. It furnishes a signpost to direct us in ing, in imagination, the train of thought which may have been ılged in by the bard of Twickenham, while he was engaged in t most delightful of rural pursuits, the improvement of landscape ıery. It tells of beauties to be developed, in the slowly adcing course of time, by means of present efforts and present ıs; and it speaks of much real pleasure enjoyed by him makes these efforts, and lays these plans; yet a plea- e lessened, it may be, by the consideration that one genera- ı must pass away, and another arise in its place, ere the ıs of the designer can fully receive material embodiment; or t, at least, the prospect of personal gratification on witness- the completion and fulfilment of fondly cherished devices, is, at best, illusory and uncertain. The landscape-gardener, in this ɔect, occupies a position different from that whereon are placed brethren in other branches of the fine arts. When the painter tches his canvass, he has commenced a work which will soon be ıpleted, and which, at its completion, will be perfect and unimvable; and when the architect has finished the highest pedi- ıt or turret of his building, that building is at its best, and the ıs of its designer are at once realised. But the landscape imver, practising his art, as it generally has to be practised, in r and bare grounds, has few materials wherewith to produce nediate effect. He may form a sheet of water, but what is er without trees to mirror their heads in its glassy bosom? may remove earth, and alter for the better the undulating sur- of the ground; and he may, in one short season, clothe this und in a living mantle of grassy verdure; but wood, the "grand l effective material of real landscape," may still be awanting. can do little to improve the appearance of natural rocks; and artificial rock-work, however well it may have been designed, st always form an insignificant feature in scenery. Arboreal ct must be produced ere a landscape can be complete. And it vhen the improver is compelled to resort for this effect to the nting of young trees, that he has to look through the dim vista nany years, ere he can see the embodiment of that which it has n his delight to cherish in imagination. That artist is fortunate o can improve scenery by cutting down trees, as Repton often ; but it is only in old places, or in new sites in old forests or odlands, that this course can be adopted. In most cases, where ɔunds have to be laid out for the first time, trees must be nted; and it is certainly one of the triumphs of modern art and ence combined, that has opened up an easy way for insuring nediate effect, or at least an effect not far distant, even where es have to be planted on ground originally bare. The trans-

plantation of large trees is not indeed exclusively a modern practice. In an elaborate and interesting history of the art, contained in the second section of the *Planter's Guide*, that history is traced from authentic records as far back as the time of the Romans; and imagination may lead us still farther back, even to the days of Oriental magnificence—of hanging gardens, raised and planted as monuments of princely wealth and munificence. But then, and even in more modern times, abundance of money, and an unlimited command of physical force, were the prime agents in carrying on the operation to any great extent, just as these were the moving powers in the erection of the huge pyramids and ponderous obelisks of Egypt. And along with the advantages which the science of mechanics has conferred on architecture, may be ranked those benefits which a knowledge of vegetable physiology is fitted to confer on the landscape gardener, when the materials that come to his hand are large and unwieldy trees requiring transplantation.

Science has, up to the present time, effected less for the forester than for his brethren, the gardener and the farmer. Individual foresters have, indeed, united science with practice in the exercise of their profession, but a body of scientific foresters has not as yet arisen. There has not been a steady demand for such a class of men on the part of landed proprietors, and the want of a national arboricultural society, such as that recommended by Sir Henry Steuart, may have had a passive effect in at once retarding the arboricultural education of foresters, and the acquirement of a knowledge, on the part of proprietors, of those peculiar qualifications which a forester ought to possess. Leaving out of view what has been done by the late amiable and talented landlord of Allanton, and a few others of a peculiar class, perhaps, in the greater number of instances, successful transplantations of large trees have been effected under the superintendence of gardeners,—men who had studied vegetable physiology, that they might be enabled to cultivate herbs and flowers in a scientific manner, and who could, therefore, act on those principles in the forest, to which they were indebted for much of their success within the garden walls. Want of success in the art of tree-lifting, on the part of gardeners or foresters, may, perhaps, in most instances, be traced to empirical practice, or to that partial and unbalanced amount of scientific acquirement, which is sometimes more dangerous to its possessor than none at all.

The fixed principles acted on by Sir Henry,—for that appellation has long been accounted sufficient to distinguish the author of the *Planter's Guide*,—must be generally known to the readers of arboricultural literature. They are but four in number—for simplicity characterises everything that is based on truth. And well may the cultivator act on short and simple rules; seeing that four short words—heat, air, light, moisture—might form titles to chapters which would comprehend a description of his art in all its branches.

With a mind fitted for scientific research, and perceiving the inefficiency and want of success attendant on empiricism in practice, Sir Henry set himself to unfold those mysteries of vegetable organisation and life, which alone could open before him a successful path to the accomplishment of his fondly cherished object—the production of immediate effect, by the plantation of large trees in suitable parts of a park which, at the commencement of his operations, was bare, and, in the words of his contemporary and friend, Sir Walter Scott, "*just not ugly.*"

The transplanted trees of Allanton park might have showed, by their amazing success, that, from previous exposure, they were possessed at the time of their removal of "thick and indurated bark," sufficient to protect the internal sap-vessels in the performance of their office; that their stems possessed "girth and stoutness," in proportion to the size and weight of the head; and that their roots and root-fibres had been carefully preserved, and even increased in number by artificial methods previously applied.

The *Planter's Guide*, on the publication of its first and second editions, gained much celebrity as a work combining practice with science; and the philosophical research of more recent times than those in which its statements first attracted general attention, tends greatly to confirm what its able and ardent-minded author had advanced respecting the true theory of arboriculture, in reference to the physical organisation of trees, the nature of the soils in which they strike their roots, and the effects of climate to which they may be exposed. There is one point, the pruning of trees on removal, on which many practical men are not inclined to go all the length that Sir Henry went, although quite agreeing with him in the principles on which his opinion was based. The scientific proprietor of Allanton could well appreciate the glorious beauty of that mystical chain which binds together, by a link consisting of an impalpable atmospherical gas, the whole universe of organised beings comprised in the vegetable and animal kingdoms of the naturalist. And, assigning due prominence to the fact, that it is by means of the leaves of trees, and other plants, that vegetable organism is developed, and the circling wheel of vegetable life kept in motion through its varying phases, he reprobates the practice of mutilating the tops of transplanted trees, by removing the branches or cutting over the leading shoot. Were branches and leaves only pensioners on the bounties of a tree, there might be some excuse for relieving a newly transplanted subject of burdens that it could ill afford to support; but when it is considered that leaves yield not even to roots the primary rank of importance in the vegetable economy, the evil results of such wholesale mutilation may be easily conceived. Still, it is quite possible to use the pruning-knife with advantage amongst the branches of a tree fated to undergo removal. Only the operator must know how to change his hand with the changing seasons; and he must also bear

in mind what belongs to trees of different kinds and different stages of growth. Slight and judicious thinning of the branches at removal may be managed without materially injuring the beauty of trees, and may even tend to a greatly increased breadth of working leaf-surface on the branches that remain. From the care taken in lifting the trees at Allanton, and from the means previously used for increasing the number of root-fibres, the necessary balance between roots and leaves was but little impaired; and the success which attended the operations of Sir Henry, shows that such slight pruning as has just been indicated, is at least not essential in a majority of cases; and it were certainly far better not to prune at all than to intrust the knife or the saw in the hands of an injudicious mutilator, or, in other words, a wholesale robber of the well-springs of vegetable life. The general commendableness of the Allanton practice may be inferred from the following brief sentences, extracted from the table of contents:—"No tree ever blown down at Allanton House; deaths one in forty, and five-and-forty." Taking climate and everything else into consideration, this is perhaps unsurpassable.

The newly published edition of the *Planter's Guide* has been dedicated to the Queen by Sir Henry's only daughter, Lady Seton Steuart. It is illustrated by six beautifully engraved plates, and contains much additional matter from notes and manuscripts left by the author. The biographical memoir of Sir Henry, which is prefixed, will be peculiarly acceptable to all who were honoured with his acquaintance; and such persons will place no little value on the fine and faithful portrait which acts as frontispiece to the volume, and which will recall the features of one who in his lifetime was so much esteemed. The second plate, entitled "View in the Park at Allanton House, as wooded by the transplanting machine between 1816 and 1821," calls up before the mind's eye a scene rich in that polished kind of beauty, which, in its removal from the rugged picturesqueness of nature, indicates the disposing hand of the landscape-gardener. The placid lake, reflecting from its bosom the clear sky, the masses of trees, the bridge, and the mansion-house, aids in conferring on the landscape materials requisite for constituting the passive sublime; and, besides its inherent beauty, this sheet of water has the power of awakening pleasing associations in the mind of the spectator, when it is remembered that it forms a silent monument of benevolence and patriotism, having been formed in a season of commercial distress by the hands two hundred weavers, who might otherwise have been in a state of destitution. There is an island in this artificial piece of water, which, by means of its thick jungle-like mass of trees, and underwood growing untouched by cattle, forms a contrast with the more polished and higher kept scenery around, and thus adds to the general effect. By hiding a portion of the water, this island indefinitely increases the extent of the lake and thus creates continu-

ity, without which, both in appearance and reality, no scenery can please, and no room is left for exercising the ever restless imagination, the gay creator of untold variety. The glades and undulating expanses of grass; the groves, and groups, and masses of noble round-headed trees; the bridge, and imaginary river; the house, as an object fitted to concentrate the ideas and prevent continuity from verging towards unfixedness; and the swans on the lake, and sheep on its banks, to add animation to the scene, combine to form a delightful landscape, and one that must have partaken of the enchantment of fairy-land to those who saw the ground in its originally bare state, and, a few years afterwards, looked on its trees in the full luxuriance of middle-age, showing no sign of having been so recently transported on a two-wheeled machine from a distance of more than a mile.

Such a landscape naturally leads to the inquiry, What would Allanton Park now be, had it been planted thirty years ago with young trees in the ordinary way? Under judicious management, a beauteous landscape might by this time have been created, and the trees might now have been as large as those that Sir Henry transplanted were at the time of their removal. But if treated as park-trees too generally have been since the introduction of modern landscape-gardening, a miserable appearance might even now have been presented. There are parks in existence, laid out about the time that Allanton was planted, which still, as well as for years past, have their beauty marred by unsightly clumps of firs, or bare and drawn-up hardwood trees in masses and in belts, devoid of that refreshing luxuriance which is visible even in an engraving of the landscape which rose at once at the bidding of Sir Henry Steuart, realising in some measure the imaginary performances of ancient story.

Kentish Turn-wrest Plough.—The *Isle of Thanet* is that fruitful portion of Kent, resting entirely upon the deep chalk rock that extends from Sandwich to the North Foreland, thence trending by the west coast to the *Reculver*, where the river Sarre becomes its boundary on the land side. This district is so rich in corn, that it has been styled the *granary of London.*

There are two drawings of the turn-wrest plough at p. 273, vol. xviii. of the *Penny Cyclopædia*, which convey accurate ideas of the old Kentish, and Ransome's new turn-wrest. In the former, the beam is curved, at the place where it joins the handles or stilts, till it acquires a horizontal position to its termination. The latter is straight throughout, rising from the stilts at a considerable angle with the ploughshare. In his notice on the use of this plough, Mr Hewitt Davis observes that—

Strangers, from not understanding the very different action of this plough to all others, are always prejudiced by its heavy, cumbersome appearance; but my experience of the better tilth and finer seed-bed it produces, has long led me to give it

a preference, for occasional uses, to all other ploughs. I shall scarcely make a Kentish farmer believe me when I say that, in my passage from farm to farm, in one of the 'midland shires' a few weeks ago, I repeatedly saw four, and in several instances five horses, breaking up for fallow, all in a length, drawing a little, skimming, wheel, iron plough, a depth of five or six inches, and no more, in a fine hazel loam, without a stone, or sufficient tenacity to make water furrowing necessary, and that such work was pointed out to me as the *ne plus ultra* of good ploughing. Such is the remarkable fertility of the soil, and favourable moisture of climate through the middle of England, that, notwithstanding their shallow tillage, they can grow as large crops of grain as better cultivated districts produce from twice the labour. Whenever I see fair crops growing upon such imperfect tilth, I cannot but reflect how much more might be gained, did these farmers try a more effectual working of the land. *The skill of the cultivator is ever called forth by the difficulties he has to encounter*; hence it is that poor land is better tilled, and the average yield of wheat per acre, over the world, differs so little comparatively with the natural fertility of the land. Whether we compare the valley of the Nile, the Spanish plains, or the alluvial steppes of the north, with the Weald of Kent clay, the produce per acre is about the same, or in favour of the poorer land.

Here follows a comparative view of several implements of tillage, the bearing of which may be collected in the following passage:—

The difficulty there is to convince farmers of the benefit that a deeper and more pulverising tillage confers, is the more surprising that gardeners are aware of the advantage they derive by deeply trenching and turning their ground to the depth of twelve, and occasionally to twenty inches, or more, and yet farmers are content to go only six or eight deep. The spade would doubtless—but for the greater expense and loss of time—be a better implement for cultivation to grow corn. The spade brings up the subsoil, turning it completely over, and, by the blow of the gardener, shatters it to pieces, while the under surface remains with its rough face unpressed; but the common plough penetrates only five or six inches, and cuts the earth into even continuous slices, laying them edgeways: at the same time, the under surface is beaten into a *hard pan* by the trample of the horses, and the weight of the plough. The turn-wrest plough penetrates and breaks up the ground more with the action of a pick, or fork; and as it turns the soil over, crumbles it to pieces, sifting to the bottom several inches of the finer crumbs, and bringing the larger lumps to the top.

Mr Davis correctly insists upon the great advantages to be derived from the chemical action of air, light, heat, and water, upon soil, loosened and torn to pieces by a deep-cutting plough. How, in fact, are the alkaline silicates, (potash and sand,) and the concealed phosphates, to be revealed, and brought into action, if the soil be left undisturbed, or moved to the depth of a few inches only. The subsoil *must* be penetrated, *pan* of every sort broken up, otherwise the chemical elements will not be eliminated. Drainage also must not be left to unassisted nature, or it will be very inadequately performed. But, to say nothing of the beautiful action of the turn-wrest plough, upon the deep chalk rock of Thanet, in many of the best farming properties about Croydon, and the chalks of east Surrey—Mr Davis closes his article by the following remarks:—

In my experience I have met every description of useful plough used in England, and although I freely admit the advantage from having on every farm, for ordinary work, two-horse ploughs of the lighter description, still I believe no farm will be well cultivated without having occasional recourse, for the purpose of trenching and breaking up the pan that is formed by the ordinary ploughs, to a heavier and different description of implement; and I have never yet met with one so effectual to deeply stir and pulverise the soil as the much abused, old fashioned, Kentish turn-wrest plough

TABLE OF PRICES, &c.

Average Price of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

heat.		Barley.		Oats.		Rye.		Pease.		Beans.	
s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1	11	33	5	21	10	28	1	44	5	30	11
0	1	34	3	20	5	27	7	40	3	31	1
9	3	31	11	19	8	27	2	41	2	30	10
8	9	32	1	19	10	26	6	39	6	31	1
9	2	32	2	22	0	27	0	36	8	31	2
8	1	31	5	21	0	27	6	40	8	29	7
7	2	29	6	20	6	27	10	37	2	27	2
7	6	30	3	20	10	25	2	36	11	28	8
8	2	29	3	18	2	30	0	32	5	27	11

LIVERPOOL.

heat.		Barley.		Oats.		Rye.		Pease.		Beans.	
s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
0	4	33	9	20	2	30	10	38	0	36	7
0	2	32	5	19	1	30	6	37	8	33	0
0	10	32	1	21	2	30	0	37	4	31	7
6	8	28	2	19	10	29	6	36	8	28	9
7	1	27	5	19	7	28	10	36	3	34	3
5	7	28	6	21	10	27	9	43	2	33	6
5	8	28	9	18	11	27	6	41	4	30	6
6	1	29	0	18	7	28	0	40	10	31	1
6	0	28	10	17	10	27	6	40	2	30	9

EDINBURGH.

Date.	Wheat.		Barley.		Oats.		Pease.		Beans.	
1848.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Dec. 7.	49	7	29	3	20	1	32	0	32	5
14.	48	4	29	5	19	8	30	0	30	6
21.	48	7	29	8	20	2	33	2	34	0
28.	46	2	28	3	19	6	28	7	29	4
1849.										
Jan. 3.	45	11	27	9	19	1	27	4	28	2
10.	46	8	27	10	19	3	28	2	28	10
17.	46	1	27	2	19	4	28	8	29	6
24.	45	4	27	4	19	11	29	10	30	8
31.	46	5	27	6	19	5	30	0	30	10

DUBLIN.

Date.	Wheat, p. barl. 20 st.		Barley, p. barl. 16 st.		Bere, p. barl. 17 st.		Oats, p. barl. 14 st.		Flour, p. barl. 9 st.	
1848.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Dec. 1.	24	2	14	1	11	8	10	6	18	0
8.	25	0	14	2	12	6	10	5	18	0
15.	24	6	13	4	12	4	10	4	18	2
22.	23	8	14	3	12	0	10	6	18	0
29.	24	2	14	0	11	9	10	6	17	10
1849.										
Jan. 5.	24	7	13	7	11	6	10	2	17	8
12.	24	2	13	8	11	8	10	0	17	9
19.	23	2	13	5	11	2	9	9	17	7
26.	23	6	13	9	11	1	10	1	17	6

ng the Weekly Average Price of GRAIN, made up in terms of 7th and 8th Geo. IV., c. 58, ., c. 14, and the Aggregate Averages which regulate the Duties payable on FOREIGN Duties payable thereon, from December 1848 *to February* 1849.

heat.				Barley.						Oats.					
Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.	
.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1	4	6	0	32	0	33	1	2	0	19	11	20	4	2	6
1	0	6	0	31	4	32	10	2	0	19	5	20	3	2	6
0	4	7	0	31	3	32	7	2	0	18	11	19	11	3	0
9	7	8	0	31	4	32	3	2	0	18	4	19	6	3	0
8	9	9	0	31	3	31	9	2	0	18	0	19	1	3	0
7	9	10	0	30	8	31	4	2	0	17	0	18	7	3	6
7	0	10	0	29	11	31	0	2	0	17	8	18	3	3	6
6	5	10	0	29	1	30	7	2	6	17	1	17	10	4	0
6	0	10	0	28	10	30	2	2	6	17	0	17	6	4	0

Rye.						Pease.						Beans.					
Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.	
s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
31	2	30	6	2	0	40	9	40	3	2	0	36	2	37	1	2	0
28	5	30	5	2	0	39	3	40	1	2	0	35	7	36	10	2	0
29	8	30	3	2	0	38	1	39	10	2	0	34	3	36	4	2	0
29	1	30	0	2	0	37	10	39	6	2	0	33	7	35	9	2	0
28	6	29	7	2	0	35	9	38	8	2	0	33	11	35	1	2	0
26	4	28	10	2	0	37	9	38	3	2	0	32	4	34	4	2	0
27	9	28	3	2	6	35	0	37	3	2	0	32	2	33	8	2	0
28	4	28	3	2	6	34	9	36	6	2	6	31	1	32	11	2	6
28	11	28	2	2	6	32	8	35	8	2	6	30	3	32	3	2	6

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Date.	Markets.	Wheat.	Barley.	Oats	Rye.	Pease.	Beans.
1848-9.		s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Dec.	Danzig.	42 to 48	18 to 25	13 to 16	20 to 27 6	28 to 34	22 to 27 6
Jan.	do.	35 6 45	15 6 23	11 6 15	18 6 25	25 32	20 26
Dec.	Hamburg	35 42	20 26	10 6 14 6	20 25 6	24 29	20 27
Jan.	do.	34 41	19 24	9 6 12 6	18 6 24 6	22 27	18 6 26
Dec.	Bremen	38 45	19 25 6	11 16	23 27 6	24 30	22 6 28 6
Jan.	do.	35 42 6	18 23 6	10 6 15	21 25 6	22 6 28	20 27
Dec.	Königsberg	36 6 44 6	20 27 6	13 6 18 6	23 6 28	23 6 30	20 27 6
Jan.	do.	34 42 6	18 6 25 6	12 16 6	20 6 26	22 28	20 25 6

Freights from the Baltic were from 3s. 6d. to 5s. 6d., and from the Mediterranean, 7s. to 10s. 6d. per imperial quarter.

THE REVENUE,
From 5th January 1848 to 5th January 1849.

	Quarters ending January 5. 1848.	Quarters ending January 5. 1849.	Increase.	Decrease.	Years ending January 5. 1848.	Years ending January 5. 1849.	Increase.	Decrease.
	£	£	£	£	£	£	£	£
Customs	4,111,802	4,682,395	570,533	..	18,615,298	18,929,360	914,062	..
Excise........	3,246,883	3,253,162	6,297	..	11,730,746	12,832,140	101,394	..
Stamps	1,564,855	1,472,598	..	92,257	6,950,546	6,110,848	..	848,698
Taxes	1,914,783	1,921,013	6,230	..	4,334,561	4,314,704	..	19,857
Post-Office....	208,000	198,000	..	10,000	864,000	776,000	..	88,000
Miscellaneous	51,746	51,709	..	37	261,926	182,166	..	79,760
Property Tax	462,567	424,434	..	38,133	5,450,801	5,347,365	..	103,436
	11,560,636	12,003,311	583,060	140,427	48,207,878	48,492,583	1,015,456	1,139,751
	Deduct Decrease		140,427		Deduct Increase			1,015,456
	Increase on the qr.		442,633		Decrease on the year			124,295

TABLES OF BUTCHER-MEAT.

Date.	LONDON. Per Stone of 14 lbs. Beef.	LONDON. Mutton.	LIVERPOOL. Per Stone of 14 lbs. Beef.	LIVERPOOL. Mutton.	NEWCASTLE. Per Stone of 14 lbs. Beef.	NEWCASTLE. Mutton.	EDINBURGH. Per Stone of 14 lbs. Beef.	EDINBURGH. Mutton.	GLASGOW. Per Stone of 14 lb Beef.	GLASGOW. Mutt
1848.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s.d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d.
Dec.	6 3 to 7 6	6 9 to 8 6	6 0 to 7 0	6 3 to 7 3	5 9 to 6 3	5 6 to 6 0	5 9 to 6 9	6 3 to 7 0	6 3 to 7 3	6 3 to
1849. Jan.	6 6 7 9	7 0 8 9	6 3 7 6	6 6 7 6	6 0 6 6	6 0 7 0	6 0 7 0	6 6 7 3	6 6 7 6	6 6

PRICES of English and Scotch WOOL.

English, per 14 lbs.

	s. d.		s. d.
rino, ...	11 6	to	16 0
n grease, ...	9 0		11 6
uth-Down,......................	11 6		15 6
Ialf-Bred,........................	9 6		12 6
eicester Hogg,....................	9 6		12 6
Ewe and Hogg,................	8 0		10 6
ocks,...........................	5 3		7 3
oor, ...	4 0		6 0

Scotch, per 14 lbs:

	s. d.		s. d.
Leicester Hogg, ...	9 6	to	12 6
Ewe and Hogg, ...	8 6		10 6
Cheviot, white,......................	7 3		9 6
Laid, washed, ...	5 3		8 6
unwashed,............	4 0		6 3
Moor, white,.......................	4 6		6 6
Laid, washed, ...	3 9		4 9
unwashed,.................	3 0		4 0

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